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CENTRAL WATER AND POWER RESEARCH STATION, POONA*

THE Central Water and Power Research Station, Poona, is perhaps the largest engineering organisation in the country with a record of useful service extending for nearly forty years. During the last decade alone, the Station has investigated nearly 200 important problems relating to measures for the protection of bridges against outflanking, of weirs against breaches by floods, exclusion of sand and silt from irrigation canals, and training of rivers.

The history of the growth of irrigation and power in our country is amply reflected in the history of the Station which began its work modestly as a Special Irrigation Division of the Bombay Public Works Department in 1916. Local problems of land drainage, reclamation and a study of the principles of water-flow engaged its attention at first. Soon, the Bombay Government found that the Research Division could put forth concrete solutions to problems, saving time and money, and promptly raised it to the status of a Hydrodynamic Research Station in 1920.

At that time the models were situated on a distributary of the main Right Bank canal of the Mutha River near Hadapsar. Despite limited facilities, the Station tackled problems connected with the design and construction of the famous Sukkur Barrage and its canals in Sind (then a part of Bombay Province). The success of the investigation brought in its train increased demands for the solution of a wide variety of engineering problems. But the water-supply for working models was inadequate at the distributary. Later models, therefore, began to be built from 1925 on the main Mutha Canal below Lake Fife at Khadakvasla. By 1934 the entire Station moved over to the new site.

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Twenty years of increasingly useful life have shown that the foundations of the Research Station had been well and truly laid. By experimenting on scale models and perfecting the designs, it has saved crores of rupees in the construction of engineering projects in the country. The usefulness of the Station was so well established that the Central Government decided to take it over in 1937 and extend its services to all the provinces and states in India. New fields of irrigation and river training research were added on, and the Station was renamed as the Indian Waterways Experiment Station.

Ten more years of tackling problems from all over the country showed that it called for further expansion. A scheme of re-organisation and establishment of new branches was accordingly sanctioned by the Central Government. The new branches of research include navigation, soils, materials of construction, statistics, physics, mathematics and hydraulic machinery. Under the scheme the Research Station became, in 1948, a wing of the Central Water and Power Commission.

Except for the model research laboratory which calls for heavy and constant supplies of water, the other sections are housed in Poona. At Khadakvasla, design problems relating to most of the major river valley projects, harbours and estuaries are being solved through scale models.

Among the navigational problems that are under study at the Station, the most complicated is that of the Hooghly. Every year 40 lakhs of rupees are being spent for silt and sand removal from ship channels between Calcutta and the sea. An unceasing watch has to be kept on the depth of the tortuous course; and there are reaches where the silting, and therefore the dredging, never stops. But it is pleasant to be able to record that the experiments on the models at the Poona Station have already started yielding promising results. An oblique spur of 1,300′ thrown from a selected spot on the bank in the Sankrail reach has succeeded in routing both the flood and ebb tides along the right bank instead of on opposite banks. In other words, ships will be assured of a constant, perennial channel in that reach without the labour of dredging.

The Hooghly Expert Committee appointed by the Government to examine the problems and solutions or the navigability of the estuary has recommended the construction of the spur in the Sankrail reach. Somewhat less complicated, but equally vital to the nation, are the problems of the Madras, Mangalore, Kandla and Cochin harbours that are being investigated at the Station.

Apart from the models, extensive research is also carried on by the Station on various subjects relating to sound engineering construction. Suitability of indigenous soils as binding material, or load-bearers or for soil cement; analysis of the geological structure of dam sites by creating light, artificial earthquakes; lines of stress and strain in various designs of structure through the use of bakelite models and polarised light; statistical estimation of water-flow in river channels from their catchments: these are some of the subjects that are under constant study at Poona.

The services of the Central Water and Power Research Station have extended even beyond the frontiers of India. On the basis of model experiments at Poona on the *Ye-U* Canal taking off from the *Mu* river in Burma, measures have been recommended to exclude sand from this important irrigation canal. Thus through its growing activities and its steady service, the Central Water and Power Research Station has indeed served as model for a number of other organisations in the country.

SIR S. S. BHATNAGAR

SIR S. S. BHATNAGAR, Secretary, Ministry of Natural Resources and Scientific Research, and Director of Scientific and Industrial Research, has been elected President of the International Committee on Scientific Research of the UNESCO.

THICKNESS OF THE GANGETIC ALLUVIUM NEAR CALCUTTA AS DEDUCED FROM REFLECTION SEISMIC MEASUREMENTS*

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THE alluvial tract in the Ganges Delta has of late received considerable attention and publicity, particularly in regard to the possibilities of occurrence of petroleum in the rocks underlying the alluvium. The Ganges Delta, as is the case with the rest of the vast Indo-Gangetic Plain, is known to be covered by a thick mantle of alluvium. The Indo-Gangetic alluvial tract is believed to be a synclinal basin, the age of this depression being Upper Eocene, though its maximum development is believed to have occurred during Middle Miocene times. The depth of alluvium in this basin is presumed to be maximum on its northern margins, the floor of the basin rising steadily towards the south as it shelves up towards the mass of the Indian Peninsula. Geodetic data seem to indicate a maximum thickness of the order of 6,500' for the alluvium in Bihar.

The existence of some major and minor 'upwarps' and 'downwarps' has been postulated by Glennie[4,5] to explain some of the observed geodetic anomalies. He has suggested a crest line under the Gangetic alluvium north of Calcutta sweeping around as a great arc between Allahabad and Banaras extending to Shillong. He believes a minor downwarp to occur as another sweeping arc in a north to south direction through Jalpaiguri and extending southwest to Dhulian, but suggests no downwarp through or near the Ganges Delta. Fox believes that the Ganges-Brahmaputra Delta is a "tectonic downwarp produced by the thrust from the Burma, Hill Tippera and Assam range direction westward towards the Bihar Plateau". The alluvium is believed to be shallow between the Rajmahal and Garo Hills which are apparently connected by an underground ridge. Glennie has stated that the Gangetic trough of Bihar and the United Provinces does not extend below the Delta into the Bay of Bengal. A glance at the Geological Map of India shows the presence of the Durgapur beds believed to be of Supra-Panchet age cropping out near the Damodar River to the north-west of Calcutta while immediately to the south and south-west of the Durgapur beds lie the igneous and metamorphic rocks interposed by the Lower Gondwana formations. On the eastern side of the Delta, to the east of the Megna River are the undifferentiated Tertiaries. What lies underneath the alluvium in between is a matter for speculation. No marine shells have been discovered in the alluvial deposits of the Delta. A number of tube wells have been sunk in and near Calcutta during the past 100 years or more, for purposes of ground water-supply and the deepest of these is the Akra Road well sunk in Garden Reach near Calcutta and taken to a depth of 1,306' without reaching the base of the alluvium. The bore hole log for this well revealed several alternations of clay, sand of varying texture, kankar and pebble beds and also a bed of sandstone and clay of 6½' in thickness at a depth of 1,017'.

The author recently carried out some Reflection Seismic measurements in the Sodepur (22° 42' N ; 88° 23' E)-Madhyamgram (22° 41' N ; 88° 28' E)-Barasat (22° 43' N; 88° 29' E) area in the 24 Parganas near Calcutta on an experimental basis to test whether the method can be used with advantage in this area for exploration purposes and to study the seismic characteristics of the area, i.e., the probable distribution of average velocity with depth, the quality and number of seismic reflections, etc. A modern portable 24-channel reflection seismic equipment manufactured by Messrs. Technical Instrument Co., Houston, U.S.A., was used. Charges of 2 lb. and occasionally more of explosives were used in shot holes at depths of 10-16' from the ground surface. Fortunately, such shallow shot holes and small charges proved sufficient as the water table in this area lies at quite small depths varying from 10-20'. The 'split-spread' arrangement of shot-point and detectors was employed following the continuous profiling method. Observations were made along two profiles, one in an approximately east-west direction running from Sodepur to Madhyamgram and the other in a NNE direction from Madhyamgram to Barasat and beyond obtaining in all over 100 records. Generally six well-defined 'reflections' were recorded in the seismograms. A specimen record obtained along the Madhyamgram-Barasat highway is reproduced below :

Of these, the third, fourth and fifth reflections were found to be the most consistent. Reflection 6 has not been always recorded. This could reasonably be attributed to the fact that sufficient energy could not always be impressed to the deeper horizons owing to the shallow nature of the shot holes and the small quantities of charge used. Deeper shot-holes could not be drilled owing to the lack of a regular

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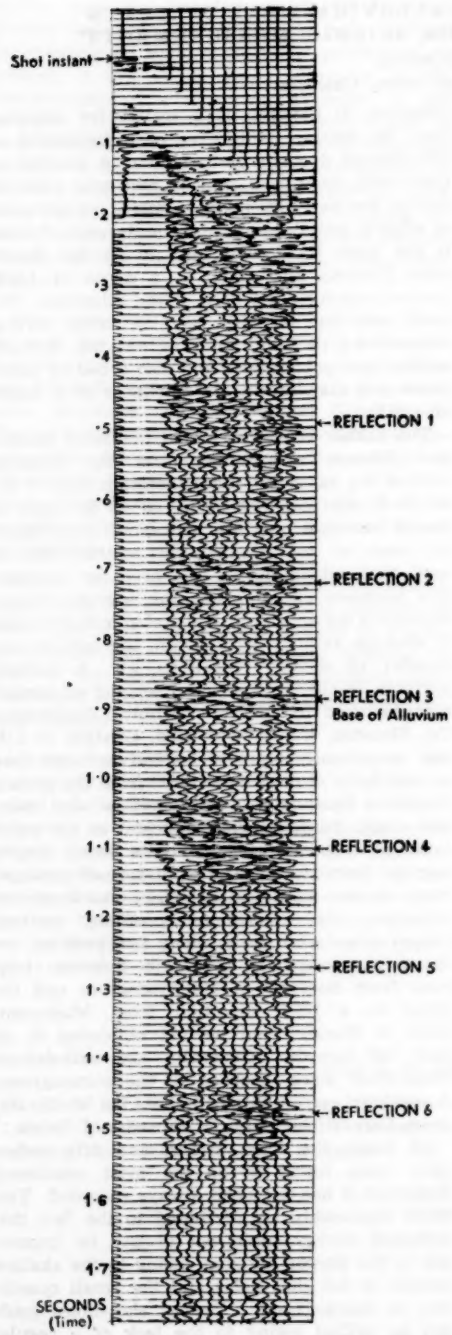

seismic shot-hole drilling equipment. Normally, one would expect that the first of the recorded reflections would represent the base of the alluvium which is a discontinuity of marked geological and seismic contrast and should, therefore, provide clear and strong reflections. An analysis of all the seismograms shows that the first two reflections, in addition to the erratic nature of their arrival times, are neither so clear nor so pronounced as the third and the later ones. Again the computed depth to the first reflection is only of 1,000′ whereas it is known from the results of the Akra well that the alluvium is thicker than 1,300′. The second reflection occurs at depths varying between 1,500–2,200′ and as pointed out are quite erratic. Also, the arrival times for the first two reflections do not tally on the east-west and north-south profiles whereas those for the later reflections do. For these reasons it seems reasonable to infer that the third reflection represents the base of the alluvium in this area, the thickness of which would then vary within a range of 2,500–3,000′. The first two reflections will then have to be attributed to some inter-alluvial phases which act as reflecting horizons. The existence of such phases is quite likely and understandable, when we bear in mind that the alluvium is not at all homogeneous in depth as shown by the results of the Akra Road well which for instance, as has already been pointed out, revealed the existence of a sandstone bed of 6½′ in thickness at a depth of 1,017′. It also seems reasonable to infer that the reflecting horizons represented by reflections later than the third are the interfaces of consolidated sedimentary rocks beneath the alluvium. This is indicated from a study of the variation of average velocity with depth.

The alluvial area seems well suited for the application of the Reflection Seismic Method and useful indications of the structure of the underlying formations may be obtained as an aid for oil exploration.

The author is indebted to Mr. M. B. Ramachandra Rao, for suggesting the problem and for valuable suggestions; thanks are also due to Messrs. S. M. Lahiri, S. N. De, N. C. Talukdar and A. K. Chowdhury, for their co-operation and assistance in the field.

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THE HYDROGEN BOMB*

LITTLE is known publicly about the construction of the hyrdogen bomb; but most probably it is based on the fusion of hydrogen nuclei into helium nuclei, taking place at very high temperatures. The temperatures necessary for such reaction are of the order of millions of degrees and can only be produced by a fission bomb; the hydrogen bomb must thus be triggered by a fission bomb. It is fairly certain that hydrogen is the main material for thermonuclear bomb, for the fusion of heavier elements requires much higher temperatures and produces less energy; but ordinary hydrogen is not suitable, and either deuterium or tritium has to be used.

The main advantage of the hydrogen bomb is that there is no essential limit to its size. It is a very safe explosive, for it will never go off unless fired by the fission bomb. The latter, on the other hand, is by nature unsafe and goes off the instant it is assembled, which puts a practical limit to its size. The load capacity of modern aircraft would, however, limit the explosive power of the hydrogen bomb to about a thousand times that of the fission bomb. The radius of damage of such explosive would thus be ten times greater than that of a fission bomb, that is, about ten miles for severe damage.

Against the background of Nature, atomic weapons are small. An average local thunderstorm releases as much energy as a plutonium bomb; a hurricane or an earthquake, a million times as much. Nevertheless, they are frightful weapons, capable of inflicting terrible destruction and wholesale death.

* From a lecture on Atomic Weapons by Prof. O. R. Frisch reported in *Nature*, March 10, p. 477, 1954.

SYMPOSIUM ON NON-FERROUS METAL INDUSTRY IN INDIA

WITH the object of focussing attention on the present state of Indian non-ferrous metal industry and discussing ways and means for stimulating its growth to meet present and future requirements, a symposium on the above subject was held during 1-3 February 1954, under the auspices of the National Metallurgical Laboratory of India, Jamshedpur. 36 technical papers received from India and abroad were presented and discussed in the 3-day session by the participating delegates, which represented industrial organisations, Government and educational institutions, C.S.I.R., besides foreign delegates from abroad.

Dr. N. P. Allen, of the Metallurgy Division, National Physical Laboratory, Teddington, England, also participated in the symposium and gave an illuminating lecture on "Titanium and Zirconium" on the opening day of the technical session, wherein he discussed at considerable length Indian resources of these metals in the general context of world reserves, their physical characteristics in relation to their multifarious applications and indicated the trends of researches under way in U.K. on these two important metals and their alloys.

Mr. E. H. Bucknall, Director, National Metallurgical Laboratory, delivered an address on "High Temperature Materials" in the course of which he discussed the phenomenon of creep and referred to his researches at the National Physical Laboratory (U.K.) on age-hardening alloys with improved creep resistances. He further put forth the requirements of high temperature materials required in gas turbines, combustion chambers, stator blades or nozzle guide vanes, turbine discs and rotor blades, etc. The lecture was profusely illustrated with slides.

The industrial data and technical know-how gained and discussed at the symposium, should no doubt serve to bring into lime-light our valuable non-ferrous mineral reserves and requirements, and to develop possible lines of expansion of this vitally important national industry in many fields.

UNION CATALOGUE OF LEARNED PERIODICALS*

THE Catalogue, prepared by Dr. S. R. Ranganathan and his assistants, is the first volume of the *Union Catalogue* and contains the names of several periodicals in Natural Sciences which are found in the libraries of Burma, Ceylon, India, Indonesia and Malaya. Volume 2 (*Humanities and Social Sciences*) and Volume 3 (*Generalia and Cumulative Index*) are to follow. This is the first attempt in this part of the globe to compile such a valuable and useful catalogue. Two other outstanding companion volumes of this type are the *Union list of serials in libraries of the United States and Canada and the World List of Scientific Periodicals* for America and Great Britain respectively. And this is again the first attempt at a classified arrangement (with an alphabetical index) of the periodicals mentioned in the catalogue, while the other two list the names in one alphabetic sequence under the first word or catch word. The advantages of a classified arrangement are, of late, much appreciated and this is, therefore, a step taken in the right direction to satisfy the needs of librarians, scholars and research workers.

The catalogue lists of the periodicals available in 210 libraries in South-Asia. Details regarding volume numbers and/or years, whether current or defunct, and where available, are furnished in a double column as in the *Union list* in a most appropriate manner. Dr. Ranganathan deserves to be congratulated on the production of this monumental work (in these days of financial stringency for libraries) which is indispensable for reference in any library. The volume is neatly printed and attractively got up.

Some small mistakes are found here and there. "Libraries", "periodical", "tuberculosis" are misspelt on pp. 15, 349, 339 respectively. In the index portion "Bengal" should not have been indented. "Allmanna", "Andhra", "Aneos", "Bilotermanns" do not come in their proper places alphabetically.

Even Dr. Ranganathan's example "Annals Math Statistics B 28 m 73, N" given on page 20, is indexed as "Annals Mathematical Statist B 28 m 73, M 1" on page 326. "Journal fur die reine und angewandte mathematik" is found in the body, but its familiar name "Crelle's Journal" is not cross-referred.

The following improvements may be made: (1) Instead of giving periodicals defunct in italics, the word (D) may be put against them just as (C) is put against periodicals current. (2) All entries in the body as well as in the index may appear in antique to eliminate the distinction between the current and the defunct peiodicals as this information is, after all, required by few. (3) The names of periodicals may be given in full in the index under the first word, not an article; for difficulty is experienced to locate long names if prepositions in them are omitted. (4) Subject entries may be furnished separately as in the British National Bibliography, 1950; for a casual user would observe that "Biology", "Chemistry", "Desert" get two different numbers each. (5) If the periodicals are also numbered as in the *World list* and the number only furnished against each periodical in the index, the user could easily locate the periodical wanted instead of remembering the long colon numbers and searching for them in the body. (6) Lastly, the key to the libraries may also be printed separately and kept in the book at the end so that it can be removed to any place in the classified part to facilitate easy identification of libraries.

R. JANARDHANAM.

* *Union Catalogue of Learned Periodical Publications in South Asia*, Vol. I. (*Physical and Biological Sciences*). By S. R. Ranganathan and others. (Indian Library Association), 1953. 11 × 9. Pp. 390. Price Rs. 25.

CHEMICAL APPARATUS AND EQUIPMENT CONGRESS AND EXHIBITION, 1955

THE Eleventh Congress and Exhibition of Chemical Apparatus and Equipment—ACHEMA XI—is to be held in Frankfurt-am-Main, during 14-22 May 1955. More than 600 firms from 12 different countries will show both their regular lines and their latest developments in the chemical apparatus and equipment field. The DECHEMA Deutsche Gesellschaft fur chemisches Apparatewesen, Frankfurt-am-Main, West 13, who is responsible for the organization and operation of the ACHEMA XI Congress and Exhibition, has divided this vast field of exhibits into the following main groups: Laboratory Technique and Practice, Measuring Control and Regulating Technique and Practice, Materials, Operation and Production Technique and New Chemical Materials and Products. Numerous pieces of machinery and apparatus in use in science and industry will be shown in operation.

LETTERS TO THE EDITOR

FINE STRUCTURE OF X-RAY ABSORPTION SPECTRA IN HOMOPOLAR CRYSTALS

IN this note the dissimilarities in the X-ray absorption fine structures for two elements in the same crystal lattice are discussed theoretically. Kronig[1] qualitatively suggested that the fields round the positive and negative ions in an ionic crystal are different and hence give rise to different fine structures. This idea is presented here in a mathematical form. Stephenson[2] reports that the fine structures in polar crystals are generally similar for the elements present therein, but for homopolar crystals, the two fine structures are completely non-repeatable. The latest reports [of the Wisconsin Conference (1950)] also suggest a similar state of affairs. The work of Prof. Kiestra has revealed the dissimilarities for several polar crystals as well. Stephenson has pointed out typical examples of Cu-Br and Zn-Se.

Mott and Jones[3] have shown that the intensity in an X-ray absorption spectrum can be expressed as

$$\left.\begin{aligned} I(E) &\propto p(E)\cdot N(E) \\ \text{or} \quad &\propto E^{3/2} \text{ or } E^{1/2} \end{aligned}\right\} \qquad (1)$$

according as we consider *s*- or p- level and use the first or second Brillion zone. For nearly free electrons we have[4]:

$$E = \tfrac{1}{2}\{E_0 \pm E_n\sqrt{(E_n - E_0)^2 + 4V_nV_n}\} \qquad (2$$

For two ions in the same lattice, all the terms are common except $|V_n|^2$. The wave function for an electron in a NaCl lattice can be written as[5]:

$$\psi_k(r) = \sum_N e^{ik r_N} \phi_N(r_N - R_N) + \sum_C e^{ik R_C} \phi_c(r_c - R_c) \quad (3)$$

Remembering $H(\psi) = E(\psi)$, we can safely conclude that

$$E = E_C + E_N + \Omega \quad (4)$$

i.e., the energy of a conduction zone can be expressed as built up of the contributions due to two ions separately, and the exchange term. For the homopolar crystals the potential energy is[4]:

$$U = \sum_{i,j} \frac{\pm a e^2}{|R_i - R_j|} + \sum_{i,j} \frac{e^2}{|r_i - r_j|} + \sum_{i,j} \left(\frac{\pm a e^2}{R_i} \mp \frac{e^2}{r_j} \right) + 1{\cdot}058 \frac{e^2}{r_0} \quad (5)$$

On a careful examination of this expression, one can see that if

$$-\sum_j \left(\frac{e^2}{r_j} \right) = \frac{e^2}{r_0} (1{\cdot}058) \quad (6)$$

holds, for a certain value of j, the fourth term vanishes for a negative ion, but not for a positive ion. Similarly,

$$\sum_{i,j} \frac{-a e^2}{|R_i - R_j|} + \sum_{i,j} \frac{e^2}{|r_i - r_j|} \mp \sum_{i,j} \frac{+a e^2}{|R_i - R_j|} + \sum_{i,j} \frac{e^2}{|r_i - r_j|} \quad (7)$$

i.e., the variation of potential energy for a positive ion is quite different than that for a negative ion and because[6]

$$I_{\alpha\beta\gamma} = H_{\alpha\beta\gamma} |V_{\alpha\beta\gamma}|^2 \quad (8)$$

where α, β, γ are the Miller indices for a plane of discontinuity, and

$$W = \frac{n^2 h^2}{8md^2} (\alpha^2 + \beta^2 + \gamma^2), \; n = 1, 2, 3 \quad (9)$$

is the energy in e.v. for $I_{\alpha\beta\gamma}$, we can see that $I_{\alpha\beta\gamma}$ can become small or vanish only for one type of ions and may exist as such for the other.

An alternate hypothesis can be put forward.[7] If one of the ions present in the lattice is capable of giving rise to white absorption line by the creation of new excitation states below the conduction zones as a result of interaction of the positive K-hole and the lattice field, the fine structures near the absorption edge of this ion will differ from that of the other ion not capable of giving a white line. The excited states are formed for all sorts of ions, but the white line is given only if allowed by the selection rules.

The author thanks Dr. G. B. Deodhar for his interest in the discussions.

Physics Dept., AMAR NATH NIGAM.
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THE FORCE CONSTANTS FOR THE NON-PLANAR VIBRATIONS OF 1, 3, 5 TRIMETHYL BENZENE

NORMAL co-ordinate analysis has been carried out to determine the non-planar valence force constants of 1, 3, 5 trimethyl benzene based on the frequency assignment of Pitzer and Scott[1] and utilising the set of force constants obtained in the normal co-ordinate treatment for the non-planar vibrations of benzene by Miller and Crawford.[2] As far as the author is aware, these force constants have not been determined previously.

This molecule belongs to the point group D_{3h}. The 9 non-planar vibrations are divided into two types $3A_2'' + 3E''$, the latter being doubly degenerate. The lowest A_2'' fundamental has not been recorded in the infra-red. But two weak Raman lines 145 cm.$^{-1}$ and 182 cm.$^{-1}$ are stated by Pitzer and Scott[1] (p. 820) to have been observed by two previous investigators. Pitzer and Scott have assigned 182 cm.$^{-1}$ to A_2'' type as this satisfies the Tellar and Redlich product rule better than the other frequency, 145 cm.$^{-1}$. The present calculations confirm the above assignment.

The elements[3] of the P.E. matrix involve the combinations of valence force constants $\frac{1}{2}H + h_m$ and $2\bar{a}_0 + \bar{a}_p$ in A_2'' type and $H - h_m$ and $2\bar{a}_0 - 2\bar{a}_p$ in E'' type, where H = the diagonal methyl wagging constant, h_m = the interaction constant between two methyl bendings, $\bar{a}_0$ = the interaction constant between methyl bending and hydrogen bending (H in *ortho* position), and $\bar{a}_p$ = the interaction constant between methyl bending and hydrogen bending (H in *para* position). These are evaluated with the help of two completely assigned frequencies (690 cm.$^{-1}$ and 840 cm.$^{-1}$ of A_2''; 275 cm.$^{-1}$ and 847 cm.$^{-1}$ of E'') of each of the above two types. Two sets of force constants are obtained

in each type on account of the quadratic nature of the secular equation. Using both the sets of the force constants thus obtained, the remaining frequency is calculated in each type. The results are given in Table I.

TABLE I

Type of vibration	Force constants ($F \times 10^{-5}$ dynes/cm.)	I	II
A″	$\frac{1}{2}H+h_m$	0·34092	0·29785
	$2\bar{a}_o+\bar{a}_p$	0·85021	0·03602
	Frequency calc.	1286 cm.$^{-1}$	179 cm.$^{-1}$
E″	$H-h_m$	0·32016	0·27568
	$2\bar{a}_o-2\bar{a}_p$	−0·46066	−0·19055
	Frequency calc.	771 cm.$^{-1}$	561 cm.$^{-1}$

The value 439 cm.$^{-1}$ suggested by Pitzer and Scott from a comparison with the frequencies of *m*-xylene agrees with neither of the values obtained in the E″ type of vibration. But from a comparison with the frequencies of 1, 3, 5 trifluorobenzene it may be seen that 179 cm.$^{-1}$ of A_2″ and 561 cm.$^{-1}$ of E″ calculated by the author compare well with the corresponding frequencies 214 cm.$^{-1}$ of A_2″ and 595 cm.$^{-1}$ of E″ observed by Nielsen[4] and confirmed recently by Ferguson.[3] A reinvestigation of the infrared and Raman spectra of the molecule is desirable to establish these fundamentals.

The numerical values of the four non-planar valence force constants are $H = 0{\cdot}38235$, $h_m = 0{\cdot}10667$, $\bar{a} = -0{\cdot}01975$, and $\bar{a}_p = 0{\cdot}07552$ ($\times 10^5$ dynes/cm.).

Full details of the paper will be published elsewhere.

Dept. of Physics, V. SANTHAMMA.
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ON THE NERINEA BEDS OF THE PONDICHERRY CRETACEOUS OF S. INDIA*

CRETACEOUS rocks of the Pondicherry area were first studied in detail by Blanford[1] and Stoliczka.[2] Subsequent collections made by Warth[3] were studied by Kossmat[4] who established the following three divisions:

3. Nerinea beds		Danian
2. Trigonoarca beds	}	Upper Senonian
1. Valudavur beds	}	

Kossmat regarded the Nerinea beds to be of Danian age on account of the presence of *Hercoglossa danica*, and correlated them with the Niniyur beds of the Trichinopoly area. Vredenburg[5] thought them to be the equivalents of *Cardita beaumonti* beds of Baluchistan. Lemoine and Furon[6] recorded the presence of Laki (*Assilina granulosa*) and Upper Eocene (*Discocyclina pratti*) horizons in bore-holes near Pondicherry. L. Rama Rao[7] noted the presence of *Nummulites* and *Discocyclina* in one of the limestones from this area and assigned an Eocene age for the same.

The present author[8] had reported in 1951 foraminiferal genera *Siderolites* and *Globotruncana* from this area. Subsequent detailed work has shown that the shell limestone containing the above genera belongs to the Trigonoarca beds and not to the Valudavur beds.

The upper part of the Trigonoarca beds contain the foraminiferal genus *Siderolites*, which is strictly Mæstrichtian in age. These beds are the equivalents of the *Lepidorbitoides*[9] bearing beds of the Ariyalur stage of the Trichinopoly District.

Between the Trigonoarca beds and the overlying Nerinea beds there is no hiatus and the latter are Danian in age, like the type area in Holland where the Danian overlies the Mæstrichtian without a break. A careful examination of the canal section near village Mettuveli, where both Trigonoarca and the Nerinea beds occur, shows that sedimentation has been continuous.

Kossmat figured two species of foraminifera from the Nerinea beds, one as *Amphistegina* and another as *Orbitoides*. An examination by the author shows that Kossmat's *Amphistegina* is an *Operculinoides*, a genus very similar to *Nummulites* but with a paucispiral coiling. His *Orbitoides* is one of the four species of *Discocyclina* that the author has recognised in these beds. The foraminifera which L. Rama Rao recognised from the so-called Eocene bed of the Pondicherry area, are from the Nerinea beds and his *Nummulites* is the same as the form that has now been recognised as *Operculinoides* and the *Discocyclina* he has figured are identical with author's species. The *Discocyclina* consist of four species and their equatorial chambers show them to be very primitive. There is nothing in this fauna which suggests a comparison with the Ranikot beds. On the other hand, field evidences show that the relationship between the Trigonoarca beds and

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the Nerinea beds is the same as that of the Ariyalur and the Niniyur beds in the Trichinopoly District. Both the Nerinea and the Niniyur beds follow without unconformity, beds which on foraminiferal evidence can be definitely dated as Mæstrichtian. The absence of *Operculinoides* and *Discocyclina* in the Niniyur beds may be due to facies difference.

The record of *Nummulites* and *Discocyclina* go back to the Danian in other parts of the world, and in the Danian of Western Georgia, U.S.S.R.[10] these forms occur together. The Pondicherry forms are small and primitive and canont be identified with any known Eocene species. Both the field and faunal evidences[11] suggest that Kossmat's classification of the beds as Danian is correct.

The author is thankful to Dr. M. S. Krishnan. Dr. M. R. Sahni and Dr. K. Jacob for their valuable suggestions and encouragement. He is also indebted to Prof. S. R. N. Rao of the Lucknow University for his guidance and help.

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MANGANIFEROUS MICAS FROM KANTAKAPALLE AREA, VISAKHAPATNAM DISTRICT*

IN the manganese pits at Kantakapalle (Long. 83° 14½′, Lat. 17° 57′) pegmatite veins carry as desseminations small, thin booklets of copper red mica. Microsections reveal the following characters.

Body colour: shades of reddish brown. Pleochroism weak in the shades of reddish brown colour. Shows straight extinction. Alteration to spongy opaque mass (Hydrated manganese oxide?) is observed. It is biaxial and is negative in sign. Refractive index (mean) $= 1{\cdot}59 \pm 0{\cdot}01$, $2V = -22°$.

Chemical tests reveal the presence of manganese in the constitution of the mineral. It is associated with quartz and orthoclase (which is highly altered) with manganese ore as an accessory. This manganiferous mica shows close resemblance to the phengites as can be noticed from the following table.[1]

	Muscovite	Ferro-muscovite	Picro-phengite	Ferri-phengite	Mica under study
2V ..	−47°	−38°	−25°	−15°	−22°
Optic Plane	⊥010	⊥010	⊥010	∥010	⊥010
N_x ..	1·552	..	..	..	..
N_y ..	1·582	1·66	1·59	1·61	1·59±0·01
N_z ..	1·588	..	..	..	..
$N_z - N_x$	0·036	0·04	0·04	0·04	..

The manganese micas associated with the manganese ores were divided by Fermor[2] into two broad groups according to their colour. The pink and rose red micas were grouped under Alurgites (related to muscovites) and brown micas were grouped under Manganophyllites (related to biotites).

Manganiferous micas with very low optic axial angles ($2E = 0$–$4°$) were reported from Central Province by Bilgrami[3] which Fermor[2b] was inclined to place in the manganophyllite group than in the alurgite group. The mica described above is related to the Alurgites (manganiferous phengites).

It is surmised that the manganese mica is a result of the infusion of pegmatite veins into the ore-body and is formed by the replacement of part of iron in phengites by manganese during the process, similar to the genesis of manganese micas in Central Provinces. Alurgites were not described earlier from the manganese formations of Visakhapatnam District.

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Dept. of Geology & Geophysics,
Indian Inst. of Technology,
Kharagpur, *November* 10, 1953.

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NATURE OF THE FINE BANDINGS IN THE DHARWAR SHALES

A STRIKING feature of some of the shales near Dharwar is the fine bandings they exhibit. The author recently examined these shales in detail with special reference to the mode of origin of these bandings in view of the suggestion made by C. S. Pichamuthu[1] that they may be of the nature of 'glacial varves'.

Such banded shales are very well exposed in the cuttings near the Dharwar Railway Station. Although the bands are usually uniform, consistent and straight, they sometimes show broad festoon-like curves but maintaining the parallelism of the bands. Each band is a 'varve-like' couplet with a coarser basal part grading upwards to a finer texture. The finer portion of a band ends abruptly against the coarser part of the next succeeding couplet. The thickness of the lower and upper part of each couplet was measured in a section showing a series of 17 such couplets and the results are shown graphically (Fig. 1-A) following the method of

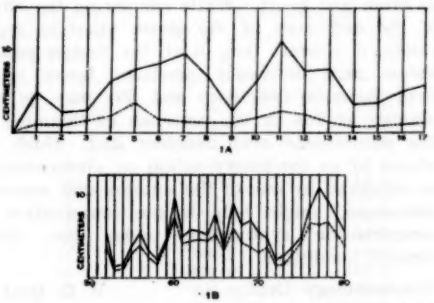

FIG. 1. Thickness variation diagrams of: (A) the banded Dharwar shales; (B) the varved pre-Cambrian slates of north-western Ontario.

De Geer.[2] For purposes of comparison, a similar graph drawn by Pettijohn[3] for the varved clays of north-west Ontario is given (Fig. 1-B).

An examination of Fig. 1-A reveals the variation in thickness from layer to layer, the average being 5-6 cm. The fluctuation in total thickness is largely a function of the fluctuation of the coarser fraction, the thickness of the finer fraction being nearly uniform. These features indicate an annual control in the deposition of these banded rocks.

Such finely banded shales have been reported by Sederholm[4] and Eskola[5] from the Archæans of Finland, and by Pettijohn[6] from the pre-Cambrians of north-western Ontario. According to these authors, varved sediments are caused by seasonal control of deposition under a cold climate though not glacial. In the present case, the complete absence of tillites in the area, the abundance of red shales and their association with the banded hæmatite quartzites preclude the possibility of a cold climate; but the bandings indicate a seasonal control in their mode of formation. The author's[7] detailed study of the banded shales and the associated rocks of this area by sedimentary petrographic methods has shown that they are all marine sediments formed under a warm climate with alternating wet and dry seasons. In this connection it is interesting to note that Shrock[8] has also recently stated, "It now seems to be generally accepted that varved sediments represent sequences of annual deposits made in quiet waters of either fresh or brackish waters". According to Zeuner[9] also there are laminated deposits "which look exactly like glacial varves although they were formed under the influence of some other seasonal rhythm, such as wet and dry seasons, or alternation of chemical deposition of carbonate with biological deposition of plankton". Thus, in the light of these recent studies, it may be inferred that the fine bandings in the Dharwar shales were formed by deposition in quiet marine waters under a warm climate, and caused by an annual control of alternating wet and dry seasons.

The writer is thankful to Prof. L. Rama Rao and Dr. C. S. Pichamuthu for their valuable guidance.

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EFFECT OF DEFICIENCY OF THIAMINE AND PANTOTHENIC ACID ON THE SYNTHESIS OF ACETYLCHOLINE IN RATS

THE presence of acetylcholine at the nerve endings and also in other tissues has attracted the attention of a group of workers in this field and researches have been directed in different laboratories to explore the mechanism of its synthesis. Previous work, mostly *in vitro*, suggest that two important vitamins like thiamine and pantothenic acid play an important role in the above synthetic process—thiamine as co-carboxylase being involved in the formation of 'acetate' group by oxidative decarboxylation of pyruvic acid[1–5] and pantothenic acid in the form of co-enzyme A participating in the acetylation of choline by activating the 'COOH' group.[6,7]

There is, however, meagre evidence to show how far the deficiency of the above vitamins in the diets of the animals affects the biosynthesis of acetylcholine in their tissues. The present investigation aims to study this aspect of acetylcholine synthesis in rat tissues.

Experiments were conducted on young rats of 50-60 g. body weight and divided into three groups of ten each. Rats of Group A were fed on a purified diet of the following percentage composition: sucrose, 65; casein, 20; salt mixture (McCollum & Davis), 4; groundnut oil, 8; cod liver oil, 2; vitamin mixture, 1.

The vitamin mixture for normal rats of Group A contained crysttalline biotin, 30 mg.; thiamine hydrochloride, 0·5 g.; riboflavine, 0·25 g.; pyridoxine hydrochloride, 0·2 g.; calcium pantothenate, 1 g.; nicotinic acid, 1 g.; folic acid, 0·05 g.; vitamin K, 0·1 g.; inositol, 50 g.; and *para*-aminobenzoic acid, 10 g.—made up to 1,000 g. with powdered sucrose, while for Group B animals, thiamine and for Group C animals, pantothenic acid were omitted from the above mixture, in order to produce the respective vitamin deficiency. The rats were fed *ad libitum* for a period of 6-8 weeks till the deficiency symptoms markedly developed in Group B and C animals. The rats of all the three groups were then killed and their brain, liver and heart were transferred into eserinised tyroide solution after promptly weighing. The tissues were then sliced, ground, ice-freezed, and after centrifugation, the supernatant fluid removed and used for acetylcholine estimation according to the technique of Feldberg[8] in a Leech muscle apparatus by comparing the contractions due to these extracts against those obtained by pure acetylcholine.

TABLE I

Showing the acetylcholine content in various tissues of experimental rats

Batch	Ach. content in μg./g. of tissue		
	Heart	Brain	Liver
Group A ..	4·65	2·90	6·10
Group B ..	2·08	1·40	0·23
Group C ..	3·06	1·77	1·00

Group A—Control; Group B—Thiamine deficient; Group C—Pantothenic acid deficient.

The average values as presented in Table I seem to indicate that both thiamine and pantothenic acid deficiencies produce an appreciable decrease in the acetylcholine content in the above tissues. In both the cases, the decrease was marked in the liver tissues as compared to brain and heart. While comparing the effect of the deficiency of the above vitamins separately, it appears that in all the tissues pantothenic acid deficiency produces lesser effect than thiamine deficiency and this may be explained as due to the presence of thiamine in the pantothenic acid deficient diet, which by virtue of its inhibitory action on cholinesterase as observed by one of the authors and reported elsewhere,[9] might help in the conservation of acetylcholine synthesised under the above dietary conditions.

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November 20, 1953.

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FORMATION OF RED PIGMENT BY A MUTANT OF *PENICILLUM NOTATUM*

PIGMENTATION in Penicillia cultures is a common occurrence.[1-10] The purpose of the present communication is to report a new type of blood-red diffusible pigment formed by the mutagenic strain of *P. notatum*.

A mutant of *P. notatum* CFTRI 1013, was grown in 250 ml. conical flasks containing 50 ml. of the dextrose-peptone broth (dextrose 40 g., peptone 10 g./1,000 ml. pH 5·0) at room temperature (26-27° C.) for the period of 30 days. The inoculation was made with a 7-days-old culture grown on dextrose-peptone agar slant where pigment formation had been found developing profusely well in an earlier experiment. The mould grew quickly and within 2-3 days cultural fluid turned to a red-coloured solution. The pigment concentration was measured in a Lovibond's Tintometer.

TABLE I

Intensity of the pigment on various days of mould growth

Period of incubation days	Lovibond units	
	R	Y
0	0·2	1·0
1	0·8	1·2
2	3·0	3·3
3	10·0	9·0
4	27·0	13·0
5	60·0	33·0
6	72·0	30·0
7	80·0	34·0
10	100·0	43·0
15	198·0	110·0
20	230·0	120·0
30	228·0	120·0

The data (see Table I) reveal that the mutant of *Penicillium notatum* secretes large concentrations of blood-red pigment. The maximum production of the pigment is obtained only after 20 days of incubation at room temperature. The pigment formation could be accelerated by providing adequate aeration and agitation in the culture medium. The mould was grown under submerged conditions in 4-litre wide-bottomed culture flasks containing 500 ml. of the dextrose broth for a period of 8 days and the metabolism solution was completely dried in shallow layers in a current of warm air (40° C.). The crude pigment obtained in this manner was found soluble in water, alcohol, acetone and pyridine but insoluble in ether, benzene and ethyl acetate. Acid and alkali neither changed the colour of the solution nor precipitated the pigment. The red pigment was adsorbed on activated charcoal from which it was partially eluted with ethyl alcohol. The pigment could not be crystallised. Further studies are in progress.

Microbiology & Sanitation Division, Central Food Tech. Res. Inst., Mysore, *November* 25, 1953.

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RIBOFLAVIN IN GRAM SEEDLINGS

THE present work refers to the effect of light on the biosynthesis of riboflavin and its distribution in the different parts of the gram seedlings. Seeds of the Chafa variety of Gram (*Cicer arietinum*) were germinated in bright sunlight, diffused daylight and total darkness in sterilised pure white quartz and periodically assayed for riboflavin content by the microbiological technique. Maximum synthesis takes place upto the 4th or 5th day, when the riboflavin content of the seedlings more than doubles that at the beginning. Light seems to have an inhibiting effect. Thus, the riboflavin content falls from 94·3 µg. per 100 seeds in total darkness to 80·0 µg. in diffused daylight and 69·4 µg. in bright sunlight, during 4 days of germination. Gustafson[1] has pointed out that in the absence of chlorophyll, plants grown in the dark have more riboflavin than those grown in light, probably due to the destructive action of light on riboflavin.

The distribution of riboflavin in the different parts of gram seedlings 24 hours and 96 hours after germination are given in Table I.

TABLE I

Riboflavin in μg. per 100 seeds°

Region	24 hours	96 hours
Cotyledons ..	39·1 (252)*	53·3 (463)*
Plumule ..	..	20·1 (1760)*
Radicle ..	9·4 (1709)*	22·1 (1771)*
Total ..	48·5	95·5

* μg. riboflavin per 100 g. of dry weight of the part.

Most of the increase in riboflavin content takes place in the plumule and the radicle and their concentration of riboflavin is considerably higher than that of the cotyledons. It was also found that if germination is arrested on the first day by removing the radicle, the remaining portion of the seeds is not able to synthesise riboflavin to the same extent.

Chemical Res. Lab., M. S. NAIK.
College of Agriculture, N. NARAYANA.
Poona-5, *December* 1, 1953.

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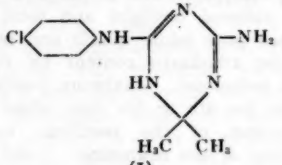
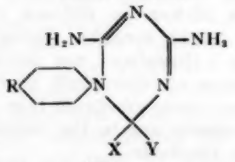
STUDIES IN DIHYDROTRIAZINES

EXTENSIVE metabolic studies[2,3,4] with proguanil (paludrine) both in man and animals have led to the isolation of an inactive triazine[1,3,4] (I) and another isomeric dihydrotriazine (II; where R = chloro and X = Y = methyl) several times more active than the parent drug when tested against avian malarials.[2,3,6] Compounds of type (II) have since been synthesized with a view to test their antimalarial activity.[2,5,6]



(I)

Inactive triazine



(II)

Active dihydrotriazine

R = halogen, alkyl, alkoxy, etc.
X = Y = alkyl (same or different)

Previously studies on aryl-alkyl-biguanides[8] had revealed high antimalarial activity of bromobuanide[7] (*p*-bromo-phenyl analogue of proguanil). A hypothetical metabolite of bromoguanide, *viz.*, 1-*p*-bromophenyl-2 : 4-diamino-6 : 6-dimethyl-1 : 6-dihydro-1 : 3 : 5-triazine (type II, R = bromo ; X = Y = methyl) has now been synthesized and characterized as monohydrated hydrochloride, m.p. 203-04° C. (Found: N, 20·28, 20·20. $C_{11}H_{15}N_5ClBr$, H_2O requires N, 19·97 per cent.). This compound was found to be 32 times as active as proguanil and twice as potent as proguanil metabolite (II ; R = chloro and X = Y = methyl) when tested against *P. gallinaceum*. On the other hand, 1-*p*-anisyl-2 : 4-diamino-6 : 6-dimethyl-1 : 6-dihydro-1 : 3 : 5-triazine hydrochloride m.p. 215° C. (Found : N, 24·31, 24·24. $C_{12}H_{18}N_5OCl$, H_2O requires N 24·6 per cent.) and 1-*p*-toluidino-2 : 4-diamino-6 : 6-methyl-ethyl-1 : 6-dihydro-1 : 3 : 5-triazine hydrochloride monohydrate, m.p. 210° C. (Found: C, 52·1, H, 7·6, N, 22·94. $C_{13}H_{20}N_5Cl$, H_2O requires C, 52·1, H, 7·3, N, 23·4 per cent.) were only moderately active. A number of dihydrotriazines of type (II) are being investigated and it appears that antimalarial activity in case of these compounds usually runs parallel to those of the corresponding N^1-aryl-N^5-alkyl-biguanides, although generally of a higher order.

The above dihydrotriazines (type II) in the form of their hydrochlorides were prepared according to the procedure of Modest *et al.*[6] 6-Methoxy-8-aminoquinoline and trihalogen-substituted anilines did not furnish the corresponding dihydrotriazines probably due to poor solubilities of their hydrochlorides.

Details of this work will be published later.

The author wishes to thank Lt.-Col. Jaswant Singh for his interest and encouragement.

Chemistry Laboratory, H. L. BAMI.
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THE AMINO ACIDS IN THE LEAF OF *AZADIRECTA INDICA* (MELIA)

THE presence of free amino acids in various parts of plants has been reported.[1] The leaf of *Azadirecta indica* (melia) has been studied for its free amino acids using the chromatographic technique.

The leaf-extract was prepared as follows: about 10 g. of the fresh leaf, accurately weighed, was mascerated with about 20 ml. of water and filtered through a muslin cloth to remove the tissue debris. The filtrate was centrifuged, and transferred to a beaker. Enough absolute alcohol was added to make the alcohol concentration about 80 per cent. The beaker was kept overnight in a refrigerator. The protein was completely precipitated and filtered off. The filtrate was evaporated under reduced pressure to a small volume (9 ml.). The extract was clear and almost free from pigments. It was shaken with chloroform to remove all traces of pigment.

Total N was determined in a sample of fresh leaves by the Kjeldahl method. Amino acid N was determined with the leaf-extract prepared as above. Amino acid analysis was done using the circular-paper chromatographic method of Giri and Rao[2] as modified in this laboratory.[3] 50 μl. of the extract was used for spotting. Seven bands were obtained on the chromatogram and were confirmed as cystine, aspartic acid, glutamic acid, alanine, proline, tyrosine and glutamine. Quantitative analysis was done by the method of Giri *et al.*[4] Individual bands were cut out and the colour extracted with 10 ml. of 75 per cent. alcohol containing 0·05 mg. $CuSO_4 . 5H_2O$ per ml. Readings for the intensities of colour of the alcoholic extract were obtained using a photoelectric colorimeter.

The results are reported below:

Total N is the leaf	..	952 mg. %
Free Amino acid N in leaf (By experiment)	..	13·356 mg. %
Free Amino acid N in leaf (by calculation from column 2 of table below)	..	13·310 mg. %

Amino acid		mg. %	Per cent. of free amino N
Glutamic acid	..	73·30	55·85
Tyrosine	..	31·50	19·31
Aspartic acid	..	15·48	14·51
Alanine	..	6·43	7·56
Proline	..	3·98	3·62
Glutamine	..	about 1	about 1
Cystine	..	,,	,,

The high concentration of free glutamic acid in the leaf suggests that the α-keto acids formed during carbohydrate metabolism undergo transamination at the expense of glutamic acid to form new amino acids. The utilization of glutamic acid and the consequent fall in its concentration leads to the breakdown of more glutamine which gives rise to glutamic acid and ammonia which can be employed in the direct amination of more of the α-keto acids. Also the free ammonia can be used to synthesise more glutamic acid from α-keto glutaric acid, an intermediate in the oxidative breakdown of the carbohydrates. Glutamic acid and glutamine seem, therefore, to fulfil in this plant, a part parallel to that of aspartic acid and asparagine in many other plants.

I wish to thank Dr. S. C. Devadatta and Dr. K. V. Giri for their keen interest in the work.

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EFFECT OF 2, 4-DICHLOROPHENOXY ACETIC ACID, ON *SOLANUM MELONGENA*, L.

STUDIES on the effect of 2, 4-Dichlorophenoxy acetic acid as a plant growth regulator applied in the manner and concentrations mentioned in Table I, to induce parthenocarpy and to increase fruitset in brinjal *Solanum melongena* L. gave the following results. To the knowledge of the authors, this is the first time, 2, 4-D has been experimented with for this purpose with the brinjal.

(i) All the treatments with 2, 4-D induced 100 per cent. parthenocarpy in all fruits, which set as a result of application of the plant growth-regulator. (ii) All the treatments with 2, 4-D showed increased fruitset over the control. The highest increase was, however, shown by 2, 4-D applied as paste in 0·0025 per cent. concentration, giving 60 per cent. of fruitset compared to 27 per cent. in control. (iii) The average weight and volume of fruits in every treatment with 2, 4-D showed a decrease over the control, but the total yields obtained

TABLE I

Method of application	Conc. of 2, 4-D	Particulars regarding mature fruits				Deviation from normal	
		%age of set	Av. days taken for maturity	Av. wt. in g.	Av. vol. in c.c.	in wt. g.	in vol. c.c.
As paste	0·0025%	60	36	60·1	81·5	+583	+835·8
	0·005%	56	34	56·5	75·2	+362	+496·4
	0·01%	50	35	55·4	72·4	+165	+200·8
As water sprays	2 P.P.M.	58	38	62·0	80·5	+578	+725·3
	5 P.P.M.	56	36	58·5	73·7	+418	+454·4
	10 P.P.M.	52	34	59·5	79·3	+327	+452·6
As talc. dust	0·0025%	46	41	45·4	58·2	−177	−270·6
	0·005%	42	39	43·3	54·3	−310	−468·9
	0·01%	40	38	44·5	57·2	−330	−465·2
Control	Non-treated	27	43	90·3	119·2	..	..

except in the case of the talc dust, as a result of increased fruitset, not only compensated for the loss in individual weight and volume, but also showed very significant increase over the control. 2, 4-D as a plant growth-regulator was however not able to induce and to stimulate any fruit development in the true short-styled flowers, which even normally produced no fruit. (*iv*) In all the treatments with 2, 4-D, the average number of days taken for maturity was less than in the control, the decrease in period ranging from 2-9 days. (*v*) In all the treatments with 2, 4-D, the apical end of the fruit terminated in a point and this was more prominent in the case of treatment with lanolin paste. Such pointedness in other fruits as a result of application of plant growth-regulators has been cited by other workers such as Krishnamurthi.[1] (*vi*) The parthenocarpic fruits showed in general some increase in thickness of exocarp; with the talc dust, however (0·005 per cent.), there was no increase in thickness of exocarp. The thickness of exocarp was in no case such as to interfere with the quality of the fruit, as seen from cooking tests.

Dept. of Agriculture, Annamalainagar, *December* 19, 1953.

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RELAXATION OF UNSTRIATED MUSCLE AND DENATURATION OF PROTEINS

ACCORDING to modern views, denaturation consists of an alteration of the specific internal structure of the protein wherein the closely folded peptide chains unfold.[1] Similarly, the contraction of muscle is supposed to be due to folding of the contractile potein; so relaxation would be due to unfolding of the muscle proteins. Thus according to these views, the process of relaxation of muscle would be similar to the denaturation of proteins.

The following experiments support the above views. Denaturation of proteins is caused by acids, bases, amides, detergents, guanidine, heat, light and urea. Some of these agents cause unstriated muscle to relax actively, i.e., relaxation of unloaded muscle is produced. Thus acids, bases, urea distilled water sodium, cyanide, sodium pyrophosphate, formamide, acetamide cause active relaxation of the contractile mechanism of unstriated muscle.[2-5] The fact that these substances act on the contractile mechanism, is shown by the observation that their effect, though somewhat diminished, persists after the muscle has been killed by immersion in saline at 50° C. for 10 minutes; unstriated muscle is killed somewhere between 40-50° C. These experiments have been performed on the circular muscle of the stomach of the frog *Rana tigrina*.

Heat is a common agent that denatures proteins. Its effect on unstriated muscle is most

interesting. When circular strips of the stomach muscle of the frog *Rana tigrina* are heated to 50° C., they contract somewhat. Further heating up to 60° C., causes them to actively lengthen by 30-50 per cent. before they are coagulated (12 experiments). Dog's stomach muscle relaxes passively. These experiments throw light both on the process of denaturation and the mechanism of muscular contraction.

Dept. of Physiology, SUNITA INDERJIT SINGH.
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February 19, 1954.

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SOME NEW OBSERVATIONS ON THE CIRCULATORY SYSTEM OF *OPHICEPHALUS STRIATUS* BLOCH. (ACTINOPTERYGII; PERCOMORPHI)

It has been known for some time[1-5] that the circulatory system is modified to a large extent in the respiratory organ of air-breathing fishes. The authors find that several features in the afferent branchial system of *Ophicephalus* have either escaped observation or have not been worked out by past workers. The peculiar nature of the origin and distribution of the third and fourth afferent branchial arteries and the location of the ventral aorta in a venous sinus are reported here for the first time.

The ventral aorta after piercing through the anterior wall of the pericardium runs forward along the under-surface of the floor of the pharynx in the mid-ventral line. It remains embedded most of its length in a venous sinus, lying on the floor of the anterior region of the pharynx, which has been named by us as the *Sub-pharyngeal Sinus* (S.Ph.S. in Fig.). It is formed by the union of the single meidan anterior inferior jugular and the first branchial veins in level with the ventral end of the third branchial arch. It extends posteriorly just upto the level of the ventral end of the third branchial arch, and communicates with the right anterior cardinal by the posterior inferior jugular vein. Laterally, the broadest portion of the sinus extends upto the mid-distance between the ventral aorta and the branchial arch. Dorsally, it is bounded by the floor of the pharynx, while ventral to it lie the pharyngeal muscles. So far as we know, there is no mention of this sinus in any relevent work on the subject.

The ventral aorta extends from the ventral end of the third branchial arch right upto the mid-distance between the first and second branchial arches, where it terminates by dividing into the first pair of afferent branchial arteries. Along its course in level with the ventral end of the second branchial arch, the ventral aorta gives off the second pair of afferent branchial arteries. Just after piercing the pericardium in level with the ventral end of the third branchial arch, the ventral aorta gives off two pairs of arteries. The *anterior or third pair of arteries is in reality the fourth pair of afferent branchial arteries,* which curves posteriorly and runs for a distance (Fig.) dorsally to the

Ophicephalus striatus showing circulatory system (respiratory region).

A.C., anterior cardinal; Af. 1–Af. 4, afferent branchials 1–4; B.A. 1–B.A. 4, branchial arches 1–4; Ht., heart; I.J.V., inferior jugular vein; S.Ph.S., sub-pharyngeal sinus.

third before traversing the fourth gill-arch. The posterior or the fourth pair of arteries is actually the third pair of afferent branchial arteries which runs nearly straight at right angles to the ventral aorta, and passing ventrally to the fourth afferent branchial supplies the third gill-arch (as seen in Fig.). A space is thus left between the third and fourth affer-

ent branchials since the fourth afferent loops back, over and behind the third branchial artery. The peculiar anterior origin of the fourth afferent artery which arises anterior to the third afferent artery is as yet unexplained. It may be that the growth of the air-sac has displaced the artery and thus this peculiarity has arisen in *Ophicephalus*.

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December 17, 1954.

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CENTRANTHERA NEPALENSIS DON, A NEW ROOT PARASITE

So far sugarcane has been known to be attacked by three angiospermic root-parasites, namely, *Aeginetia indica* Linn. (*Orobanchaceæ*), and *Striga lutea* Lour. and *S. euphrasioides* Benth. (*Scrophulariaceæ*). This is the first report of *Centranthera nepalensis* Don (*Scrophulariaceæ*) as parasitic on roots of sugarcane and two other graminaceous plants.

Hooker[4] recorded *Centranthera* in Australia, Burma, China, Ceylon, India, Java, Malaya and the Philippines. *C. nepalensis* Don was recorded in Bombay State by Cooke[1] and Santapau,[6] in Nepal by Don[2] and in Bihar and Orissa by Haines.[3] Like these authors, Pennell[5] also who dealt with all the species of *Centranthera* in his very comprehensive accounts of *Scrophulariaceæ* in Western Himalayas, made no mention of the parasitic nature of this nor for the matter of fact, of any other species of this genus.

The parasite, which resembled *Striga euphrasioides* Benth. was found growing very close to sugarcane clumps in village Belwa, Bettiah (District Champaran) in October 1952 and was collected as a new species of *Striga*. It was identified subsequently as *Centranthera nepalensis* Don and was found to have definite haustorial contacts with roots of sugarcane. On further observation in the same locality, it was found to parasitise *Cynodon dactylon* Pers. and *Imperata arundinacea* Cyr. In North Bihar, on sugarcane it was met with as frequently as *S. euphrasioides* Benth. In South Bihar, however, in Kharagpur (District Monghyr), its incidence was fairly high in waterlogged areas.

It is moss-green when young, turning reddish brown on aging. It is 15-22" in height, stouter than *S. euphrasioides* Benth. and with scarlet-coloured flowers larger than those of all the *Striga* species. Its roots are pale while those of *Striga* are darkish in colour. Seed-coat is straw-coloured with reticulate curved markings while that in *Striga* species is dark (coffee-brown to jet-black) with parallel markings or in straight meshes.

Authors are indebted to Sri. K. L. Khanna for kindly providing facilities for investigation and Sri. S. K. Mukerjee, for his identification of the plant.

Central Sugarcane Res. Station, Pusa (Bihar), S. L. SHARMA.
D. RAO.
July 20, 1953. H. C. JHA.

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THE ANTIPODALS IN THE FAMILY AMARANTACEAE

IN Amarantaceæ, during the formation of the embryo sac cæcum, the antipodals are usually pushed laterally where they persist up to the early stages of the development of embryo. This has been noted in *Digera arvensis*,[1] *Alternanthera sessilis*,[2] *Achyranthes aspera*,[3] *Pupalia lappacea*,[4,5] *Allmania nodiflora*, *Cyathula tomentosa* and *Aerua lanata*.[5] In *Psilostachys sericea*[6] the antipodals degenerate before the secondary elongation of the embryo sac. The number of antipodals has been reported to be three in all the investigated species except *Pupalia lappacea*.[5] "Here," to quote from Kajale,[5] "the antipodals are three in the beginning, but they soon begin to multiply. All of them divide to form a small mass of cells as shown in Figs. 14 *e*, *g* and *h*. Their total number is variable, but up to 30-40 cells can be commonly counted in the later stages. The cells of the antipodal mass are generally small, full of cytoplasm and without vacuoles, but among

them a few larger cells are also found and these show prominent vacuoles (Fig. 14 *g*)." However, during my investigations of the floral morphology of certain species of the family, I failed to confirm the multiplication of the antipodals in *P. lappacea*. The antipodals no doubt appeared to be more persistent here than in other species, and in many sections I even found them considerably enlarged as in Kajale's Fig. 14 *g*, but in not one instance could I locate the multiplying antipodals. In some cases I did come across a mass of cells as shown in Kajale's Fig. 14 *h* but this was found to be nucellar in origin. It was seen that the strongly curved embryo sac cæcum in the species encloses a central perisperm and *in an oblique section* a few cells of the perisperm are cut off in such a manner that they appear to be embeded in the cavity of the embryo sac. Could it be then that the "antipodal mass" figured by Kajale is also nucellar ? Only a re-checking can possibly settle this point. Till then we may regard *Pupalia lappacea* to be in line with other species of the family in possessing three antipodals but to differ from them in its antipodals becoming much larger and vacuolated during the later stages of embryo sac development.

I am grateful to Prof. P. Maheshwari for the loan of some literature from his personal library, and to Mr. S. L. Chhajlani and Mr. R. N. Kapil for help in various ways.

Dept. of Botany, T. S. Bakshi.
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URINE-INDUCED PARTHENOCARPY IN *LYCOPERSICUM ESCULENTUM* AND *CAPSICUM ANNUUM*

Urines of the cow, bull and buffalo at concentractions of 1 : 500; 1 : 1000 and 1 : 2000 in the case of tomatoes, and 1 : 300; 1 : 400; and 1 : 500 in the case of chillies were applied to substitute fertilization in the development of fruits. A few of the partially opened buds were also emasculated and sprayed with urines. Frequency of spraying when reduced to once a week helped in the formation of fruits as against the dropping off of flowers noticed in tri-weekly sprayings.

Table I

Percentage of parthenocarpic fruits developed under different urine treatments

Plant material	Concentration 1 in.	Urine of		
		Cow	Bull	Buffalo
Tomato ..	500	18	50	42
	1000	33	29	27
	2000	30	22	..
Chillies ..	300	53·5	51·2	56·8
	400	46·3	46·2	45·8
	500	50·0	37·2	33·9

In tomatoes there is no formation of fruits in 1 : 2000 buffalo urine treatment. Bull and buffalo urines in 1 : 500 concentration show better response than cow urine in an even dose. Weaker doses of cow urine appear to be more effective than of the other two urines in fruit production (Table I).

In chillies 1 : 300 concentration gives a better response in the production of parthenocarpic fruits in all the three urine treatments. Weaker concentrations of bull and buffalo urines give a decreasing percentage of fruits, whereas cow urine in 1 : 500 concentration shows a better response even though at 1 : 400 it gives a low percentage of fruits.

In tomatoes the fruits developed under 1 : 500 concentration treatments in all the three urines appear to be bigger than the control and they contain a few seeds each, obviously because the emasculations were carried out in partially opened buds.

In chillies, perfect seedlessness was ensured by using only the unopened buds for emasculation. Noteworthy increases in size of fruits were achieved in 1 : 300 cow and buffalo urine treatments and 1 : 500 cow and buffalo urine treatments. The increases comprised both the linear dimension and width. In the case of buffalo urine, at 1 : 400 and 1 : 500 concentrations and bull urine at 1 : 300 concentration, the increases were confined to width alone.

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POLYEMBRYONY IN *OPUNTIA DILLENII* L.

MANY years ago Englemann[1] figured a seed of *Opuntia tortiopina* as having two embryos. Braun[2] suggested that the four cotyledons which he had noticed in *Opuntia glaucophylla* may indicate a fusion of two embryos and hence polyembryony, though he admits that it may also be explained as fasciation. Hull[3] reported polyembryony in *O. rafinesquii* and Ganong[4] in *Opuntia vulgaris*. Archibald[5] observed the occurrence of nucellar embryos in *O. aurantiaca* but recorded the absence of endosperm. Since this seemed rather unusual, we undertook a study of *O. dillenii*, which is naturalised in many parts of India and was at one time a troublesome weed (recently brought under control by the cochineal insect). Our observations are briefly summarised below.

In the ovules the percentage of sterility is very high and a healthy mature embryo sac is of rare occurrence. In most cases degeneration takes place very quickly, the antipodals degenerating first, then the egg apparatus, and finally the polar nuclei. Nucellar embryony is of frequent occurrence in the ovules which survive and the first signs of formation of such embryos are seen when numerous endosperm nuclei have been formed.

Nucellar embryos originate in the upper half of the embryo sac either from a rather irregular mass of tissue which lies at the micropylar end of the embryo sac; or from the nucellar cells along the wall of the embryo sac (Fig. 1). The cells which give rise to the embryonic masses usually border the embryo sac cavity but sometimes they may be deep-seated. These cells become richly protoplasmic and often contain starch grains. They are soon seen to round off and develop a slightly thicker wall. The first division is usually transverse or oblique (Figs. 1, D-F). Further divisions result in the formation of an embryonic mass (Fig. 1, C) which later projects into the cavity of the embryo sac. As many as six groups of embryonic cells formed in this manner have been observed in a single ovule (Figs. 1, 1 A-F).

There is apparently a keen competition among the embryos and as development proceeds, only one or two persist. In the seeds, we dissected, only one well-developed embryo was seen, sometimes associated with another much smaller embryo having two short and sometimes unequal cotyledons (Figs. 2, 3). In *O. aurantiaca*[5] also only one or rarely two embryos survive in the mature seed though in *O. vulgaris*[4] there may be more than one smaller embryo along with a large one. When a single embryo occurs in a seed of *O. dillenii* this is usually thicker, and occasionally shows three cotyledons instead of two (Fig. 4) as also reported by Ganong.[6] He offers no explanation but we consider this condition to be the result of an early fusion of two embryonic masses.

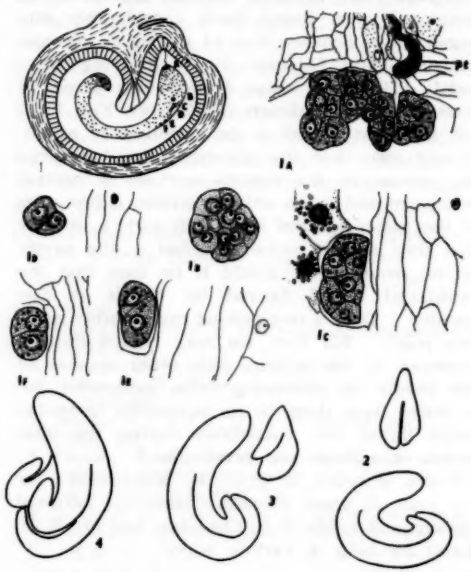

FIG. 1. L.s. ovule showing position of adventive embryos at A—F. The dots in the embryo-sac represent endosperm nuclei, × 11.

FIG. 1 A-F. Magnified view of embryos A-F shown in previous figure, × 275 (*pt.* = pollen tube).

FIGS. 2 and 3. Two pairs of embryos, each obtained from a single seed, × 6.

FIG. 4. Embryo with three (slightly displaced) cotyledons, × 6.

Tiagi[7] has recently reported that there is only one "apparently zygotic" embryo in each embryo sac. While the possibility of the occurrence of a zygotic embryo cannot be ruled out altogether, in our material this did not seem likely. We saw no trace of the zygote in older ovules while adventive embryos were frequent and showed varied positions. Ganong also states that embryos arising at the micropylar end or along the side walls are always of nucellar origin and that the egg is not seen when embryo formation begins.

Archibald[5] reports that in *O. aurantiaca* adventitious embryos are formed from the nucellus without previous pollination, fertilization or the formation of endosperm tissue,

and she therefore considers this case to constitute a new type of adventive embryony. The complete lack of an endosperm would certainly be most remarkable, if true. In *O. dillenii* Tiagi[7] has already reported that there is a free nuclear endosperm consisting of many nuclei and we are able to confirm it. Ganong observed the same in *O. vulgaris* and Huber[8] in over half-a-dozen other genera of the family in addition to *Opuntia*. Ganong observed pollen tubes in the ovules of *O. vulgaris* and also reports fertilization but states that the egg disappears early in the development of the ovule. Pollen tubes have also been observed in *O. dillenii* (Fig. 1, A) but it remains to be seen whether the endosperm is the result of triple fusion or pseudogamous stimulation by the pollen tube.

Grateful thanks are due to Prof. J. Venkateswarlu (Andhra University, Waltair, S. India), who very kindly provided some of the material on which this study is based, and also to the Indian Council of Agricultural Research for a research grant.

Dept. of Botany, P. MAHESHWARI.
University of Delhi, R. N. CHOPRA.
Delhi-8, India,
January 14, 1954.

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BEHAVIOUR OF TAPETAL CELLS DURING MICROSPOROGENESIS OF *ADENANTHERA PAVONINA* LINN.

OUT of the layers of the parietal tissue of the anther, tapetum is of considerable interest as well as physiological significance. Two main types have been recognised, the secretory type and the amœboid type. In the former, cells remain *in situ* without breaking their walls and this type is of common occurrence. In the amœboid type, walls of cells break down and their protoplasts protrude and wander between the sporogenous cells. In *Adenanthera pavonina* (Mimosaceæ), the behaviour of the tapetum appears to be as intermediate between the two types. The innermost layer of the parietal tissue in the anther-lobe develops as the tapetum and its cells remain uninucleate throughout behaving like the secretory type prior to meiosis in microspore mother-cells. Before reduction divisions, the tapetal cells lose contact with each other and migrate between groups of mother-cells which they begin to nourish. In their act of migration and wandering, these tapetal cells are somewhat similar to the amœboid tapetal cells but their identity with them is not altogether perfect because their cell-walls are intact. Such a behaviour of tapetal cells, as far as the author is aware, has not been recorded so far. Eventually, the tapetal cells disappear when meiotic divisions are complete.

The author desires to express his gratitude to Professor R. L. Nirula for valuable suggestions and criticism.

Dept. of Botany, V. R. DNYANSAGAR.
College of Science, Raipur, M.P.,
January 18, 1954.

ALDRIN AND DIELDRIN FOR TERMITE CONTROL

EXPERIMENTS were conducted in a field known to be heavily termite infested, the two species being *Microtermes obesi* Holmgr. and *Odontotermes assmuthi* Holmgr., with various insecticides. The treatments were all applied to setts at planting when lying exposed in furrows immediately before covering them up with soil in the form of dusts, suspensions, or emulsions.

Speaking generally, every treatment was better than control and results were highly significant statistically. Germination was highest (44·4 per cent. and 45·8 per cent.) and incidence to setts was least (14·3 per cent. and 12·2 per cent.) in treatments with Aldrin and Dieldrin respectively compared to control where germination was only 19·1 per cent. and incidence to setts 79·3 per cent. The conventional treatments with B.H.C. chlorinated camphene or DDT were in the next range of efficiency, but considerably inferior to the former two. Incidence to the growing crop, throughout the year, was 2·1 per cent. and 4·7 per cent. in Aldrin and Dieldrin treatments respectively as against 48·1 to 75·2 per cent. in other treatments and control respectively. Even repeated applications of BHC to the crop did not materially reduce the incidence and in these cases the protection to the crop was limited to at best 3-3½ months after planting whereas in the case of Aldrin and Dieldrin treatments, the treatments gave complete protection right up to the end of the year till the crop was harvested. These were adequately reflected in yield of sugarcane per acre also

where Aldrin and Dieldrin were head and shoulders above the rest giving an extra yield of 121·9 and 116·0 md. per acre.

It has been found that these two insecticides can be applied even at later stages of the life of the crop, if termite infestation appears. Previously there was no help in such cases.

C. S. R. S., Pusa, Bihar, *January* 20, 1954.

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PHYSIOLOGY OF DIGESTION IN *LEPTOCORISA VARICORNIS* FABR. (HEMIPTERA: COREIDAE)

INVESTIGATIONS on the physiology of digestion in *Leptocorisa varicornis* Fabr., an important pest of paddy, were taken up in order to throw light on the physiological relationship between this insect and its host plants.

The digestive system of this insect consists of two sets of salivary glands, a short foregut, a long midgut and a very short pear-shaped hindgut. The midgut shows four distinct regions: a sac-like *first ventriculus*, a narrow tubular *second ventriculus*, a small dilated *third ventriculus* and a narrow tubular *fourth ventriculus* which is flanked with two rows of numerous minute cæca. The latter contain certain micro-organisms.

For the determination of enzymes in these organs, the usual practice of preparing the extracts by grinding the tissues was avoided in order to exclude the endoenzymes. The latter, in the living insect, are not liberated in the lumen of the gut and, hence, cannot take part in the digestion of food before it is absorbed. After clearing the alimentary canal of the insects by feeding them with distilled water for about 24 hours, they were fed on substrates corresponding to the enzymes to be tested. The contents of the lumen of different parts of the gut were then drawn out and incubated with appropriate substrates at 38° C. To this mixture were added a suitable buffer and a few drops of toluene. The action of the enzymes was detected by testing for the appearance of hydrolytic products and disappearance of the substrates by the methods recommended by Cole[1] and Feigl.[2] In all cases controls were carried out with extracts heated in boiling water for about 30 minutes.

The process of digestion was also checked up by feeding the insects on different substrates and then tracing their fate in the alimentary canal at different intervals after feeding.

The distribution of various enzymes in different parts of the digestive tract is indicated in Table I.

TABLE I

Distribution of enzymes in the digestive tract of Leptocorisa varicornis

Organ	Amylase	Maltase	Invertase	β-glucosidase	Alkaline proteinase
Salivary glands	×	–	–	×	–
1st ventriculus	–	–	×	–	×
2nd ventriculus	–	–	×	–	×
3rd ventriculus	×	×	–	×	–
4th ventriculus	–	–	–	–	–
Hindgut	–	–	–	–	–

× indicates the presence of the enzyme. Polypeptidase and lipase were not detected in any part of the digestive tract.

The ingested food, mixed with the salivary secretion, is collected in the first ventriculus where the proteins and part of the starch are hydrolysed by the alkaline proteinase and amylase respectively to yield polypeptides, dextrins and maltose. The enzyme invertase, though present in this region, digests sucrose when the food reaches the second ventriculus. β-Glucosidase, however, does not act upon β-glucoside, that may be present in the food, until the latter reaches the third ventriculus. In the latter region the digestion of starch and maltose is also completed by the action of amylase and maltase. The polypeptides do not seem to undergo further hydrolysis in the lumen of the gut. The products of digestion are conducted to the fourth ventriculus in regulated quantities and are finally absorbed. It may be noted that the above mentioned enzymes have not been detected in the fourth ventriculus and the hind-gut.

These results indicate that the morphological differentiation of the midgut in the Heteroptera is correlated with a corresponding physiological differentiation.

Dept. of Zoology, University of Delhi, Delhi-8, *February* 1, 1954.

K. N. SAXENA.

1. Cole, S. W., *Practical Physiological Chemistry*, 1944, Cambridge.
2. Feigl, F., *Qualitative Analysis by Spot Tests*, 1947, Elsevier, New York.

TRIALS WITH PESTOX-3H, ON SUGARCANE SCALES

DURING 1953 a serious infestation of Scales (*Trionymus sacchari*) developed on Co. 513, Co. 313 and Bo. 11 varieties of sugarcane growing in 8′ × 8′ cages. This opportunity was utilised for experimental trials with 0·5 per cent. spray of Pestox. Observations on popu-

Variety	Pre-treatment	1st post-treatment	% reduction	Statistical merit	2nd post-treatment	% reduction on pre-treatment	Statistical merit
			1. Percentage of leaves affected*				
Co. 513	4·01	0·98	75·56	Highly significant	0·60	85·58	Highly significant
Co. 313	13·27	7·89	40·54	do	3·71	72·42	do
Bo. 11	10·78	2·49	76·90	do	4·28	57·79	do
			2. Number of Scales per leaf*				
Co. 513	27·67	0·43	98·08	do	0·78	96·99	do
Co. 313	31·64	8·74	72·38	do	3·12	91·73	do
Bo. 11	18·82	2·11	88·79	do	5·92	75·66	do
			3. Number of Scales per square inch of the affected leaf				
Co. 513	91·90	0·93	97·78	do	1·84	95·46	do
Co. 313	26·28	15·04	42·11	do	7·58	71·10	do
Bo. 11	12·35	3·12	74·74	do	7·23	42·94	do

Figures transformed to sin/P.

lation was taken by nested sampling method (30 leaves per cage) immediately before and 8 and 38 days after treatment. Results presented in the table below show the high efficacy of the treatment, which was most so in Co. 513. In Co. 313 the translocation appeared to be slow but active life sustained better than in Bo. 11.

Entomology Section, S. B. D. Agarwala.
C.S.R.S., Pusa, R. N. Prasad.
February 2, 1954.

1. Agarwala, S. B. D. and Huque, M. W., *Ind. Jour Entomol.*, 1952, **14**, 3.

BIOLOGICAL CONTROL OF THE BRINJAL MEALY BUG AND APHIS BY *HYPERASPIS MAINDRONI* SIC.

In West Bengal *Phenacoccus isolitus* G. and *Aphis fabæ* are two serious pests on brinjal. They attack the plant almost simultaneously and quickly build up large colonies. The tremendous drain of plant sap caused by the feeding activity of these two pests produce characteristic white patches on the leaves. If the mealy bug infection becomes very high, the stems of the plant appear as if dusted with white powder.

A tiny predator beetle on brinjal mealy bug and aphis was recently collected along with their larvæ and eggs, and reared in the laboratory. They were identified as *Hyperaspis maindroni* Sic. of the family Coccinellidæ. This beetle had been so far recorded only from South India and this is the first record of the species from West Bengal.

In the field where DDT and BHC were used, a damaging infestation of a second generation of the pests was found to have developed. This infestation developed from eggs, larvæ and adults that were unaffected by insecticides. The consistency with which this infestation was associated with an application of the insecticides suggests that these materials interfere with the natural control by enemy insects of these pests. It is quite evident that biological control which at the beginning of the incidence of the pests is ineffective, becomes of considerable importance after some time.

Nirmal Ch. Chatterjee.
Ministry of Food & Agric.,
Govt. of India, Calcutta-40,
March 10, 1954.

PROTEINS IN HEALTH, DISEASE AND INDUSTRY

A SYMPOSIUM on Proteins in Healht, Disease and Industry is to be held under the auspices of the National Institute of Sciences of India, during October 8-9, 1954, at New Delhi. Among the subjects for discussion are: Food proteins, their amino acid composition and nutritive value; Functions of proteins in the body including their relationship with vitamins, hormones, enzymes, etc.; Protein and amino acid preparations in food and in therapy; Biosynthesis of amino acids and proteins; Synthesis of amino acids and polypeptides; Structure and molecular weight of proteins; Methods of analysis of proteins and amino acids; Bacterial products from proteins and their uses in therapy; Preservation of proteins and protein foods; Industrial application of proteins. Those intending to participate in the symposium are requested to send in their abstracts before 30th June 1954 to Dr. U. P. Basu, Convener, Bengal Immunity Research Institute, 39, Lower Circular Road, Calcutta-16.

REVIEWS

Mathematical Aspects of the Quantum Theory of Fields. By K. O. Friedrichs. (Interscience Publishers, Inc.), 1953. Pp. viii + 272. Price $ 5.00.

Despite many fundamental difficulties in quantum field theory, a close agreement has been obtained between theory and experiment for quantum electrodynamics. This would seem to indicate the need for a close inspection of the mathematical foundations of the subject; this close inspection would, it is hoped, show more clearly the cause of the difficulties.

The inspection is given in a precise manner by Friedrichs, who considers the basic notions of field theory for non-interacting boson and fermion fields and also simple interaction problems. The notation used is that of general operator theory and not of quantum field theory; this is only to be expected in a mathematical approach to the subject through operator and Hilbert space considerations.

At the beginning of the book, the symbolic nature of operators with commutation relations containing the δ-function is noted. That these symbolic operators can be given a precise definition in terms of other operators is shown later, these latter operators depending on elements of a general Hilbert space and not on points of a Euclidean space. However, these well-defined operators are not explicitly used for the development of the theory, and a loss of internal consistency of the development results. This loss would appear to be compensated for by keeping the development closer to the intuitive mathematical approach of the quantum field theorist, and thus allowing him greater ease in reading the book.

The mathematical definition of biquantized operators and the Hilbert space on which they act is fully developed from single particle operators and states, and gives rise to the Fock space representation.

This representation is then applied to a boson field in interaction with a given source distribution. An exact solution of this system is obtained, and an interesting analysis of the infra-red catastrophe is given. A similar analysis is given of a field modified by a linear homogeneous force, and transition probabilities are again determined.

Since a mathematically satisfactory treatment of non-linear interactions between quantised fields canont be given, these interactions are not considered. Fredrichs even suggests that fundamentally different laws of non-linear interaction should be adopted, so as to admit of mathematical treatment; this, however, is not considered in the book.

The treatment throughout is in a non-relativistic form, and it would seem a pity that no attempt has been made to incorporate explicit relativistic invariance into the foundations of the theory.

J. G. TAYLOR.

Tables of 10^x, NBS Applied Mathematics Series 27. (Order from Government Printing Office, Washington 25, D.C.). Pp. 543. Price $ 3.50.

Although there are a number of handy tables of logarithms to 10 or more places, these tables necessitate the use of inverse interpolation for finding the antilogarithm. Thus, a table of antilogarithms is needed. The present volume gives antilogarithms to the base 10, or 10^x in the form of two tables, a readily interpolable table for 10-decimal accuracy and a basic radix table for 15-figure accuracy. When used in conjunction with logarithmic tables in any extensive computations involving logarithms and antilogarithms, the *Tables of* 10^x will save considerably more labour than will logarithmic tables used alone. The ease of performing linear interpolation by machine eliminates the need here for differences and proportional parts. The fine interval of 10^{-5} in the argument permits determination of the full 10-decimal places by linear interpolation alone with a small 10th place correction that can be done mentally.

Low Frequency Amplification. By N. A. J. Voorhoeve. (Philips Technical Library), 1953. Pp. xv + 495. Price Rs. 24-4-0.

The volume under review represents one of the latest additions to the very popular Philips Technical Library Series and is, according to the authors, 'a treatise on the technical and scientific principles and the modern practical use of LF amplification'. Though acoustics, in the last few decades, has been revolutionized by the rapidly developing electronic measuring methods, there has been no corresponding attempt by text-book writers to present an integrated account of audio problems. The pre-

sent volume fills that need adequately and hence will be of immense benefit to the amateur audio enthusiast and the practising acoustical engineer.

More than half the book is concerned with electronic principles, but emphasis is laid on those topics relating to audio work. Valuable design by data on Class B amplifiers, pre-amplifiers, output power tubes, feed-back circuits, and matching networks has been included in this portion. The acoustics problems dealt with are mostly applied in nature with emphasis on microphones, loudspeakers, PA systems, and recording devices—disc, tape and film. Throughout the book, there are extensive references to, and data on, Philips products, as is characteristic of other volumes in this series.

Finally, there are two general comments, this reviewer has to offer: (i) the utility of the book is considerably enhanced by an extensive bibliography appended to every chapter, and (ii) the price of the book is very reasonable in these days when the purchase of a technical book is, for most of us, almost an investment.

It is hoped that such a book as this will find wide acceptance as a standard text-book in our engineering colleges where acoustics and audio figure in the curriculum. RAM K. VEPA.

Data and Circuits of Television Receiving Valves. (*Book III c of the Series of Electronic Valves.*) By J. Jager. (Philips Technical Library, Eindhoven), 1953. Pp. 216.

Television receivers presented completely new problems to the tube designer and the present data book reflects the result of a decade and a half of intensive research and experimental development.

The front end of a TV-receiver, operating in the vhf or uhf range requires tubes with reduced transit-time limitations and very small equivalent noise resistance. In addition, they have to meet the general wide-band requirement of high transconductance combined with low tube capacitances: EF 80 and ECC 81 are designated to this part of a television receiver. Both are also used for signal conversion, whereas EF 80 (pentode) is exclusively employed in the i.f. parts. The double diode EB 91 has separate cathodes and thus can be used simultaneously as video detector and DC restorer. The PL 83 is the typical video output tube feeding one of the picture tubes listed in this data book (MW 36-44, MW 36-24, MW 43-43). Even for the sound part we find special tubes, like PL 82, ECL 80, EQ 80. The difficult problem of horizontal output amplifier can be solved by using the new PL 81 in combination with PY 80 and PY 81 booster tubes. The rectifier tube EY 51 is able to handle the high peak inverse voltage of 17 KV in a fly-back EHT system.

The last third of the book brings many circuit descriptions with full explanations. Briefly, a highly useful reference book for any TV designer.

R. FILIPOWSKY.

Radio Engineering, Vol. I. Second Edition. By E. K. Sandeman. (Chapman & Hall), 1953. Pp. 779. Price 60 *sh.*

The book first appeared in 1947 and since then it has become a very familiar text-book. There are many good reasons for its increasing popularity: the fact that two volumes of nearly 1,400 pages are exclusively devoted to radio broadcasting proves that we may be sure to find in these volumes a good deal of special information which has to be omitted in more general text-books. The author's close connection with the engineering field in one of the world's largest broadcasting corporations (BBC) can be felt when reading any of the 16 chapters of the first volume. Many operational features of particular circuits or sets are disclosed, and frequently we learn interesting facts from otherwise unpublished technical reports resting in the files of this Corporation. Last but not least, we have to congratulate the author for his efficient selection of the topics to be discussed more elaborately. Thus he has restricted the presentation of valve fundamentals to only 30 pages while extending on the other side the chapter on modulators to over 110 pages and the paragraph on feeders, aerials and coupling devices to 130 pages.

Unfortunately, we cannot expect such a comprehensive work to be absolutely perfect at its birth. Reviewers of the first edition disclosed many shortcomings and errors and the friends and admirers of the author hoped that a second edition would be highly improved in this respect. The preface to the second edition stresses again the close link-up of the book's content with BBC practice. This fact has been much criticised by reviewers of the first edition (see for example, *Wireless Engineer*, February 1948, page 62) and, indeed, it was generally expected that a second edition would be on a broader basis including well established high power transmitter practice outside the realm of the BBC. The preface then continues to assure the reader that "with this very able

help and a certain amount of diligence on the part of the author, the book has been very thoroughly revised".

The reader has no reason to belittle this statement. The very fact, however, that still quite a few small errors are prevailing (take as an example page 32, where the dimensions of ρ, the specific resistance, is given in ohm/cm.^{3}, instead of ohm $\times$ cm.) indicates that only by co-operation of a large number of specialists, communicating any discovered deficiency to the author, the book may finally become *the* standard text-book on transmitter technique. To reach this aim it will be unavoidable for the author to introduce the MKS system of units, as has been suggested by several reviewers of the first edition.

Apart from a new section on transmission line filters and a treatment of noise factor calculation in receivers there is no major change from the first edition. Approximately one-third of the book is devoted to fundamentals of AC circuits and resonance. A very useful essay on harmonic analysis and distortion precedes the tube fundamentals and the amplifier chapter. Oscillators and drive equipment lead the second half of the book, which contains an excellent survey of transmitter types (BBC) and their operation and maintenance, besides the previously mentioned large chapters on modulators, aerials and feeder lines.

R. FILIPOWSKY.

Condensed Pyridazine and Pyrazine Rings (Cinnolines, Phthalazines and Quinoxalines). By J. C. E. Simpson. (Interscience Publishers, Inc.), 1953. Pp. xvi + 394. Price $ 12.50. (Subscribers to the series, $ 11.25.)

The author of this monograph, the fifth volume in Dr. Weissberger's series on the chemistry of heterocyclic compounds, died in February 1952, and the later work connected with the production of the book was carried out by Dr. C. M. Atkinson, a colleague of Dr. Simpson on the scientific staff of the Medical Research Council in England. The book is regarded as a continuation and extension of Mayer-Jacobsen's *Lehrbuch der Organischen Chemie*, Vol. II, 3, and the literature coverage therefore commences mainly from 1917. The preface is dated September 1950, and the references include 1949 literature. Part I deals with cinnolines, to the chemistry of which Dr. Simpson himself has made a substantial contribution. Throughout the book a general account of the synthesis and properties of a given type is followed by a table of the physical properties of a series of compounds and references to the original literature. The treatment includes cinnolines containing additional fused rings, both homocyclic and heterocyclic, condensed phthalazines and azaphthalazines, quinoxalines condensed with homocyclic rings and with nitrogenous heterocyclic rings, and azaquinoxalines. Ultraviolet absorption spectra of cinnoline and quinoxaline derivatives, basic strengths of cinnoline, phthalazine and quinoxaline derivatives (stated as p*Ka*), and antibacterial and parasiticidal activities of cinnoline and quinoxaline derivatives are given in three Appendices.

2 : 3-Dihydroxyquinolines react with *o*-aminophenol to form oxazine derivatives and with *o*-phenylenediamine to form quinoxaloquinoxalines; these are mentioned, but not the reaction with monamines. The 2 : 3-dihydroxyquinoline derivative obtained by the condensation of 1 : 2-diaminoanthraquinone with oxalic acid condenses with amines such as *m*-toluidine to form vat dyes (*e.g.*, Indanthrene Brilliant Scarlet RK).

The present volume is as comprehensive and scholarly as others in the series which are a necessary addition to a chemical library.

K. V.

Inorganic Syntheses, Vol. IV. *Editor-in-Chief*: John C. Bailar, Jr. (McGraw-Hill Book Company, Inc.), 1953. Pp. xii + 218. Price $ 5.00.

This volume which is the fourth in the series is divided into 8 chapters, the arrangement being based on Mendelejev's periodic classification including the A and B sub-groups. It deals with the method of preparation of some 58 compounds, which although of importance in general research, are either not readily available or should preferably be prepared by the research worker for immediate use.

The method recommended for the synthesis has in each case been confirmed independently in different laboratories. Each synthesis is prefaced by a short account of the principles involved and the methods available. The procedure is then set out in detail indicating the exact quantities of reactants to be employed as well as the necessary experimental conditions. The apparatus to be employed is described with all essential details and often illustrated by clear sketches. It is noteworthy that only the simplest possible set-up and common manipulative technique, such as, rudimentary glass-blowing are suggested in each case, without sacrifice of efficiency or yield of the products. The successive steps in the synthesis

are fully described with due emphasis on the precautions called for. Experimental data concerning the yields and the purity of the product obtained as well as of the associated impurities are furnished in each case along with its important physical and chemical characteristics.

This publication is a most helpful reference book for preparative inorganic chemistry. The information given is so precise and complete as to enable any chemist to adopt with confidence the synthetic procedures suggested.

The printing and get-up of the book is excellent, and it is singularly free from any misprint or error in the text or flaws in the diagrams. It can be heartily recommended as a thoroughly reliable book of reference for all chemists alike. K. R. K.

Soap Manufacture, Vol. I. By A. Davidsohn, E. J. Better and J. Davidsohn. (Interscience Publishers, Inc.), 1953. Pp. xii + 525. Price $ 12.50.

Interscience Publishers, Inc., have been publishing a series of very valuable monographs on 'Fats and Oils' and the present volume is a very welcome addition to the series. The book contains information on the theoretical principles of soap-making, raw materials of soap manufacture, practical aspects of soap-boiling processes and special soap products. Each of these major divisions is admirably treated.

The study of the principles of saponification is of very great importance to the manufacturer as well as to the colloid chemist. The treatment of this subject in Part A is masterly. An young student of the subject has often to puzzle about the various raw materia's he has to work with. He has only to read through Part B to find all the information he wants. The practical aspects of soap-boiling processes and special soap products are elegantly treated in Parts C and D.

The reviewer had, for some years, the responsibility of instructing young graduates in the chemistry of soap manufacture in close collaboration with a leading firm. One of the difficulties he then experienced was to recommend a good readable book on the subject. That difficulty may be said to have been completely overcome by the present volume. It is not only rich in correct and precise information, but is handy, free from all avoidable mistakes and sustains the readers' interest to study it with profit.

This book can be heartily recommended not only to the manufacturing chemist and the technician but also to all who have interest in colloid and other branches of physical chemistry. It should find a place in every scientific or technical library. K. N. M.

Practical Chromatography. By R. C. Brimley and F. C. Barrett. (Chapman & Hall, Ltd.), 1953. Pp. 128. Price 15 *sh.* net.

This laboratory manual gives in a nutshell, and without sacrificing clarity, a good account of the practical details of various procedures usually employed in chromatographic analysis. In addition to paper chromatography, column chromatography based on adsorption, partition and ion-exchange mechanisms receives a scholarly and authoritative treatment. The last chapter is devoted to the description of various designs of fraction-collectors. As is to be expected in a book of this kind, theoretical considerations are relegated to the background. The descriptions given are clear and concise and are accompanied by illustrations wherever necessary. Emphasis is placed on the actual *modus operandi* rather than on the application of the methods. The book is a useful practical guide for chromatographic analysis, but unmistakably colored by the progressive research interests and activities of the authors, who have made important contributions to the development of chromatographic techniques. The book is remarkably free from typographical errors and can be recommended to all research workers who are either already using or contemplating to use the elegant techniques of chromatography in their investigations. K. V. Giri.

Annual Report for 1952-53 of the Nutrition Research Laboratories. (Coonoor, South India). Pp. 40.

The report deals with the activities of the Nutrition Research Laboratories of the Indian Council of Medical Research for the year 1952-53 and gives in the main an account of the biochemical, clinical, pathological and field investigations carried out during the year. Vitamins and proteins have been studied on the biochemical side while in clinical nutrition, extensive studies have been carried out on different aspects of nutritional œdema, and several important results reported. Field work such as nutrition survey and determination of hæmoglobin levels in children have also been

carried out. The report is interesting to read and the 17 publications listed in the end give an idea of the significant contributions made by this institution in the field of nutrition research.

P. S. SARMA.

The Birds of Burma. By Bertram E. Smythies. Thirty-one colour plates by Commander A. M. Hughes. (Published by M/s. Oliver & Boyd, Edinburgh), 1953. Pp. 668. Price £ 4-4-0.

The first edition of 1,000 copies of this book printed in Rangoon in 1940 was sold out rapidly with very few copies selling outside Burma. In the Japanese invasion, the books available in Burma were seized and shipped to Tokyo where they were later destroyed in an air raid. During the war, an American ornithological paper listed the number of copies in existence and (speaking from memory) only 12 or 14 were traceable, the three copies in Bombay being overlooked.

The second edition is welcome as it fills an urgent need in an extremely interesting ornithological area. Few countries have this wealth and variety of bird life in so small an area. The Indo-Malayan element is prominent but the numerous hill ranges form interesting lines of division between different races. The preface to the second edition contains the interesting story of the first edition while the introduction deals with the history of ornithology in Burma and goes into some detail regarding the zoological affinities of the area. The author appears to have succeeded in bringing under one cover all available information regarding the birds of Burma and it will therefore be an indispensable reference for any work on the birds of that area.

The book is excellently got up and the 31 coloured plates each illustrating 8-10 birds which were included in the first edition are reproduced. It is unfortunate that the colours in many cases have not blended well and the black and greys in crows, bulbuls, treepies, jays and several other birds have in many places become blue and green.

The author laments that a chapter in Burma's ornithological as well as political history closed in 1948 and draws attention to the fact that he is unable to find any contribution by a Burman national in the bibliography to his work, but it is hoped that this excellent handbook, though highly priced for the beginner, will be used by many young enthusiasts in that country.

HUMAYUN ABDULALI.

Books Received

Spot Tests—Inorganic Applications, Vol. I. By Feigl. (Elsevier Publishing Co.), 1954. Pp. xii + 518. Price 45 *sh.*

Elsevier's Encyclopædia of Organic Chemistry. Vol. I2-B, Series III. Edited by F. Radt. (Elsevier Publishing Co.), 1953. Pp. xiii + 3965-4560. Price £ 21.

Chemistry of Carbon Compounds, Vol. II, Part B. By E. H. Rodd. (Elsevier Publishing Co.), 1953. Pp. xiv + 489-1,092. Price £ 5-5-0.

Servo Mechanisms. By John C. West. (English University Press). (Orient Longmans, Madras-2), 1953. Pp. 238. Price 25 *sh.*

Australian and New Zealand Botany. By J. McLuckie and H. S. McKee. (Associated General Publications Ptg., Ltd., 166, Phillip Street, Sydney, Australia), 1954. Pp. xx + 758. Price £ 4-4-0.

Fluorescence Analysis in Ultra-Violet Light, Fourth Edition. By Julius Grant. (Chapman & Hall), 1954. Pp. xvi + 560. Pirce 52 *sh.* 6 *d.*

Fruit from Trained Trees. By Stanley B. Whitehead. (McMillan & Co.), 1954. Pp. viii + 151. Price 10 *sh.* 6 *d.*

Yeast Technology. By John White. (Chapman & Hall), 1954. Pp. xvi + 431. Price 55 *sh.*

The Mechanism of Enzyme Action. Edited by W. D. McElroy Bentley Glass. (The Johns Hopkins Press, Baltimore 18 Maryland), 1954. Pp. xvi + 819. Price $ 11.00.

Tables of Circular and Hyperbolic Sines and Cosines for Radian Arguments. (NBS Applied Maths. Series 36). (U.S. Govt. Printing Press, Washington 25 D.C.), 1953. Pp. x + 406. Price $ 3.00.

Detergency Evaluation and Testing (Interscience Manual 4). By J. C. Harris (Interscience Publishers, Inc.), 1954. Pp. x + 210. Price $ 3.75.

SCIENCE NOTES AND NEWS

Occurrence of Kodurite in Patna State, Orissa

Shri P. C. Pande, University Department of Geology, Nagpur, writes as follows :—

In the specimens collected by the author, the kodurites are exposed only in some manganese quarries which consist of manganese garnet (spandite), manganese pyroxenes, felspar and quartz. The associated felspars are kaolinised and have given rise to large masses of kaolin. The unaltered portions consist of orthoclase and microcline.

The garnets are pinkish red, friable and in shining grains, occasionally associated with apatite of bluish green colour. The manganese pyroxenes are dark green and in some specimens, the prismatic cleavage is well developed. At some places pseudomorphs of manganese ore after pyroxenes are also found. Quartz is abundant as irregular grains.

Ravenelia on *Abrus precatorius* Linn.

Dr. B. Padhi, Department of Botany, Ravenshaw College, Cuttack, writes as follows :—

Leaves of *Abrus precatorius* Linn. were found very heavily infected in the winter months of 1952-53 and 1953-54, in the Botanical Gardens of the Ravenshaw College, Cuttack. In one case almost all the leaflets were affected. The fungal pathogen has been identified as *Ravenelia ornata* Syd., which has been reported on leaves of *A. pulchellus* Wall. in Northern India (Butler and Bisby, *The Fungi of India*, 1931, p. 77). The rust on *A. precatorius* differs from the original description (Saccardo, *Syllago Fungorum XXI*, 1912, p. 738) of *R. ornata* in measurements of teleutosporic structures, but the author does not think that such differences are significant enough to warrant the creation of a new species. The rust collected on *A. pulchellus* growing in the same locality also shows similar magnitudes of variation.

Physicians' Report on Tetracycline

A report on the first extensive clinical trials with the new broad-range antibiotic tetracycline shows it to be effective against several diseases, and well tolerated by patients. The drug was named 'tetracyn' by scientists of Chas. Pfizer & Co., Inc., who discovered it as a result of their identification of the chemical structure of terramycin.

On the basis of their experience with 179 tetracycline-treated patients, the majority of whom suffered from infections of the respiratory and urinary tracts, Dr. Maxwell, Finland, and group of Boston physicians conclude in a recent issue of the *Journal of the American Medical Association* that the antibacterial activity of tetracycline closely resembles, and in most respects is almost identical with that of oxytetracycline (terramycin) and chlorotetracycline (aureomycin).

Dermatitis due to Penicillin

The urticaria which has been occurring among nurses and midwives is the result of sensitisation of the skin produced by contact with the antibiotic solution. Streptomycin appears to be the worse offender. The method suggested by the Ministry of Health, U.K., designed to minimise the risk of this kind of dermatitis, is to expel the air from the hypodermic syringe used for injecting the antibiotic while the needle is still in the bottle. The time-honoured technique in which the syringe is charged, removed from the bottle and inverted before expelling the air thereby stands condemned.

Fellowships for Atomic Research

The Indian Atomic Energy Commission has decided to award 10 Junior Research Fellowships of the value of Rs. 250 per month each and six Senior Research Fellowships of the value of Rs. 400 per month each for study and research in cosmic rays and nuclear physics. These Fellowships will be tenable for two years, which may be extended as a special case by the Atomic Energy Commission for a further period not exceeding one year.

Applications on the prescribed form, obtainable from the Atomic Energy Commission, Old Yacht Club, Apollo Pier Road, Bombay-1, should be submitted through the University or institution concerned so as to reach that office not later than May 15, 1954.

University of Madras Prizes

The Maharaja of Travancore-Curzon Prizes for 1954-55.—Two prizes, one in each of the following groups of subjects, will be awarded by the Syndicate for the best essay or thesis written by any graduate of the Madras Uni-

versity in the subject on any topic dealing with one of the subjects mentioned in the following two groups: (*i*) Chemistry, Bio-Chemistry and Agricultural Chemistry; (*ii*) Pharmacology, Pathology and Bacteriology. The value of each prize is Rs. 250. Competitors should submit their theses so as to be received by the Registrar not later than the 1st March 1955.

Sir William Wedderburn Prize, 1955.—The prize which will consist of books of the value of Rs. 45, will be awarded to the student, who having qualified in chemistry for the B.Sc. (Honours) or M.Sc. not more than two years previously, has shown aptitude for research. Competitors should submit their theses so as to be received by the Registrar not later than the 30th April 1955.

Further particulars may be had from the Registrar, University of Madras, Madas-5.

Endeavour Prizes

The Imperial Chemical Industries, Ltd., Publishers of the scientific review, *Endeavour*, have offered the sum of 100 guineas to be awarded as prizes for essays submitted on the following subjects: The Upper Atmosphere; Heat of the Earth; Coal as a Raw Material; Water-Supply; The Span of Life and Colour Photography. The competition is restricted to those who are under 25 years of age on 1st June 1954.

The essay, which must be in English and typewritten should not exceed 4,000 words in length and only one entry is permitted from each competitor. In judging the results, special attention will be paid to the originality of approach to the subject, and great importance will be attached to literary style.

Entries should reach the Assistant Secretary, British Association for the Advancement of Science, Burlington House, Piccadilly, London, W.1, before 1st June 1954.

Burmah-Shell Scholarships for 1954

Burmah-Shell have advertised for the third year in succession two Loughborough College Scholarships for 1954 to be awarded annually for a period of four years to Indian students who intend to adopt Mechanical Engineering as their profession. The scholarships will normally be tenable from the commencement of each college session, *i.e.*, September at Loughborough College, Leicestershire, England. The closing date for the applications is 1st June 1954. The appropriate application forms can be had from: The Secretary of the Committee of Selection, Burmah-Shell Scholarships (Loughborough College of Technology), C/o. Burmah-Shell Oil Storage & Distributing Co. of India, Ltd., P.O. Box No. 688, Bombay.

Royal Institute of Chemistry—N. India Section

At the Annual General Elections of the North India Section of the Royal Institute of Chemistry held at Delhi on 13th March 1954, the following office-bearers were elected for the year 1954-55: *Chairman*: Dr. B. Viswa Nath; *Hony. Secretary and Treasurer*: Dr. G. S. Saharia; *Hony. Auditor*: Mr. B. N. Sastri.

Dr. K. R. Nair

The D.Sc. Degree of the London University has been conferred on Dr. K. R. Nair, Statistician, Forest Research Institute, Dehra Dun. Dr. Nair is also a Fellow of the American Statistical Association and has made extensive contributions relating to Fisherian Theory of Experimental Designs, in the field of Statistics

Award of Research Degree

The University of Poona has awarded the Ph.D. Degree in Chemistry to Shri Keshav Gangadhar Marathe for his thesis entitled "Syntheses of Karanjin Analogues by the Ranjorwar Reaction, etc.".

The University of Poona has awarded the Ph.D. Degree in Chemistry to Shri Gangadhar Vyankatesh Bhide for his thesis entitled "A New Method for the Synthesis of 2-Acyl-3-hydroxy-coumarones, etc.".

CORRECTION

Vol. 23, No. 2, p. 52: Note on "Study of the Action of Acid on Chromate Ion by Glass Electrode": In Table I, Column 4, please *read* $K_2 \times 10^{-2}$ *for* $K_2 \times 10^2$.

Vol. 23, No. 2, p. 42: Article on "The Occurrence of C_8-Unit in Natural Products": In Structural Formula VII, *read* OCH_3 *for* OH.

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